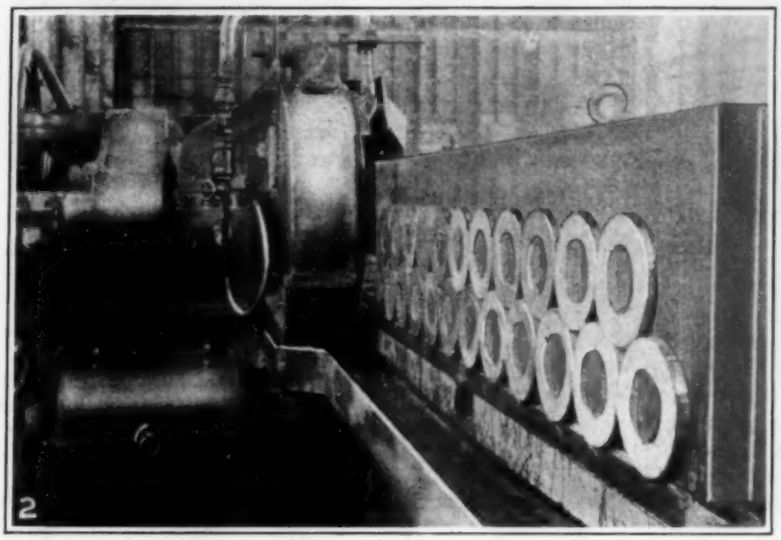
American Machinist

Volume 63 New York, November 19, 1925 Number 21



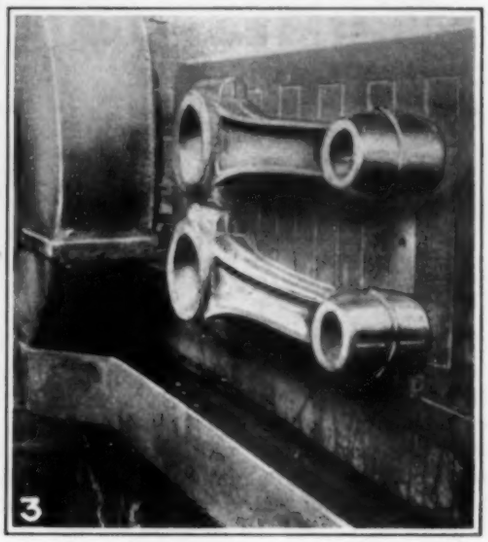


Fig. 2—Grinding disks in gang form. Fig. 3—Grinding connecting rods

The Grinding Machine on Production Work

By Frank W. Curtis
Associate Editor, *American Machinist*

Improvement of abrasives and grinding machines — Changing work designs to suit grinding practice—Work adapted to grinding—Various grinding operations

THE improvements that have been made in the manufacture of abrasives have been responsible, to some extent, for the use of grinding as a production process and, likewise, have necessitated the development of the grinding machine in accordance with the possibilities that have been offered by this method of finishing. It is not necessary to go back far to recall that the grinder was used chiefly for producing a high-class finish more than quantity work, but today there is little doubt that grinding is a production operation. The advances made in grinding practice have greatly assisted manufacturing methods in general, both from a standpoint of quality and quantity, and without doubt there will be continued improvements judging from the successful machines that are now available.

Grinding is considered one of the best methods of producing a high-grade accurate finish on metal units, but its use is not limited to accurate work only, for it has been found profitable, in some cases, to use

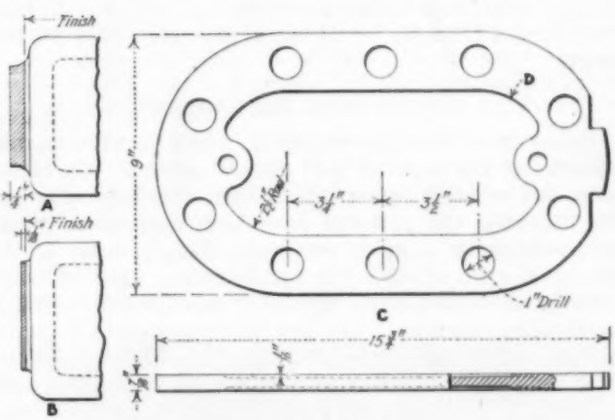


Fig. 1—Changing work design to suit grinding conditions

abrasives for finishing purposes where wide limits are permissible. The various grades of grinding wheels that are now available can be applied successfully to practically all classes of work. It is important, however, that a correct grade of wheel be selected for a given piece of work in order to make economical grinding possible. The selection of the proper wheel is somewhat similar to the application of correct speeds and feeds for machining operations in that the characteristics of different metals require individual grades. There is no rule that can apply universally for a certain grade of wheel to a given piece of work, although

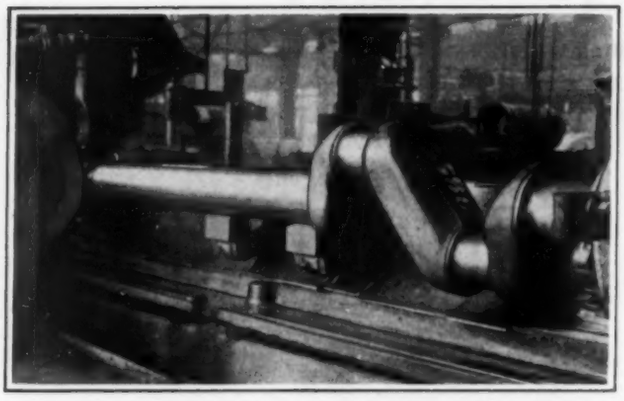


Fig. 5—Finishing long end of a crankshaft

the variations for different classes of metals are small.

Grinding machines are now furnished in so many styles that few classes of work cannot be ground if conditions warrant. It is useless to use a grinding operation to produce a highly polished finish merely for looks. For this reason, work to be ground should be carefully analyzed to determine the advantages, considering of course the comparative cost and quality of the work produced.

One of the many shops that have applied considerable thought to the art of grinding is the De La Vergne Machine Co., New York, N. Y., manufacturer of ice machines and Diesel oil engines. At this plant a few years ago there were but two or three grinders, whereas, at present, this type of machine has been increased to a much larger number, being applied to work that can be ground to advantage. A variety of grinding machines is to be found in this plant, and future plans call for a further expansion, including a special internal-grinding machine for cylinder liners that have a capacity of 24 in. in diameter by 6 ft. in length.

Changing Work for Grinding

It has been found necessary to make slight changes on some of the parts so they may be ground. On castings, for example, where $\frac{1}{4}$ in. was formerly allowed for finishing, the patterns have been changed so that now only $\frac{1}{16}$ to $\frac{1}{8}$ in. is removed. Fig. 1 shows at *A* the usual $\frac{1}{4}$ in. of stock left for finishing, while at *B* is shown the change made necessary when work is to be finished by grinding. Another important point in connection with grinding is the reduction of surface to be ground. Many times it is possible to relieve the pad or portion to be ground without injury to the work, either in strength or in operation. At *C* is shown an example of this kind. The surface was formerly finished over the entire area, whereas, when grinding was adopted, the pattern was altered so a recess of $\frac{1}{16}$ in. reduced the surface to be machined as shown at *D*. The work was not weakened by this change while the saving in wheel cost and the faster feeds permissible quickly paid for the cost of the change.

An example of surface grinding in gang form is shown in Fig. 2. The work shown on the magnetic chuck of a Diamond grinder is a cast-iron flange. Twenty-three pieces are arranged on the chuck as shown and $\frac{1}{16}$ in. of metal is removed from each side. The work is 7 in. in diameter, having a 4-in. center recess and a finished thickness of $\frac{11}{16}$ in. The limits of accuracy are not important as ±0.01 in. is allowed. The finish obtained, however, is smooth and true to thickness. The work was formerly turned, using a standard chuck for holding. The time for finishing both sides was 7 min. The time required for grinding 23 pieces is 90 min. or less than 4 min. each. The wheel used is 36 in. in diameter, made of 12 segments of No. 512, grit 141, grade F, manufactured by the Carborundum Co. The table feed for this operation is 20 in. per minute.

Another operation performed on the same machine is shown in Fig. 3. The work is a pair of connecting rods to be ground on both ends to the limit of $\begin{matrix}+0.000\\-0.001\end{matrix}$ in. The diameter of the large end is 7 in. and that

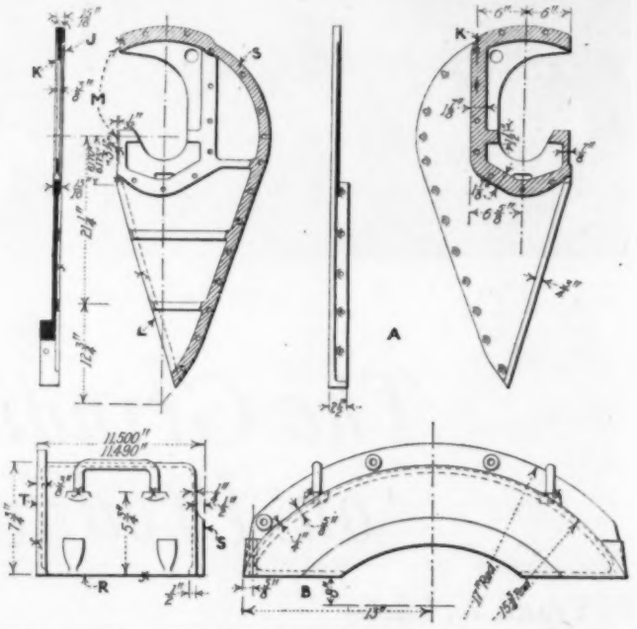
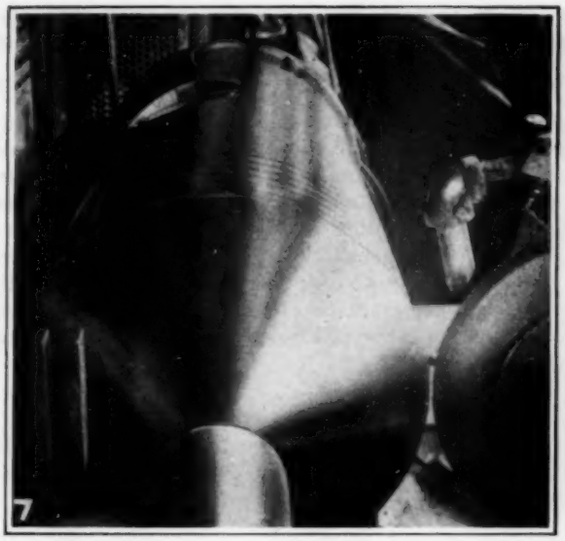


Fig. 4—Examples of work suitable for surface grinding

of the small end 4 in. The center distance between holes is 22 in. Approximately $\frac{1}{16}$ in. of metal is removed from each side of the rod, the total time being 65 min. per set complete. The time required by the former process was 115 min. per set. These times are from

Fig. 6—Grinding a wristpin



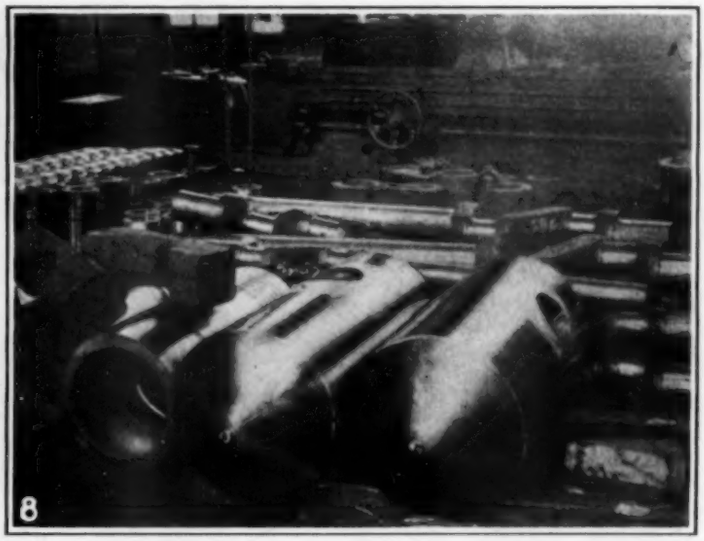


Fig. 7—Piston set up for grinding. Fig. 8—Variety of work that is finish ground

floor to floor. An Aloxite wheel is used for the operation, and a dressing for each side of the rod prior to removing the last few thousandths is required. The material of the work is a high-carbon steel, drop forged.

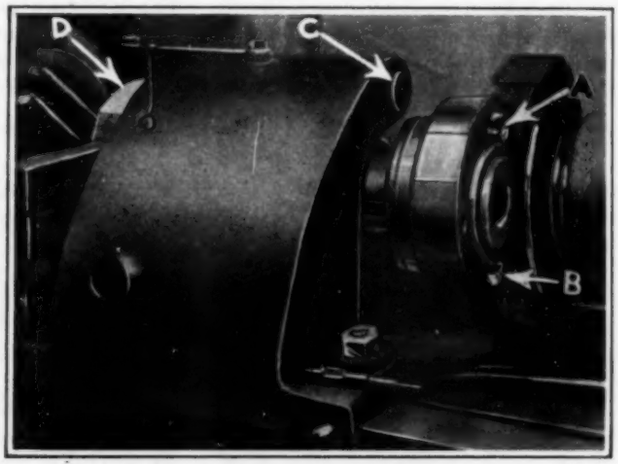


Fig. 9—Cam-grinding attachment

In Fig. 4 are shown two examples of work that are well adapted to grinding. At *A* is shown the gear-casing side cover, a cast-iron piece that is thin in section. On account of its shape it was difficult to hold the piece for machining and, likewise, the feed used was limited. In grinding this piece it is held on the magnetic chuck of the Diamond grinder shown in Figs. 2 and 3. Small steel blocks are used for aligning the work to the correct grinding position. The former machining time for completing the surfaces *J*, *K*, *L* and *M* was approximately 4 hr. while the present grinding time is 145 min. The work shown at *B* is a cast-iron cover requiring a finish at *R*, *S* and *T*. The work is laid on the table of the machine and the face *R* is ground to size, after which it is located on the surface *R* for the finishing of the sides *S* and *T* to a tolerance of 0.01 in. The former machining time on this piece was 115 min. and the present time for grinding is 80 min. Both of these parts show the possibilities of grinding work of a clumsy nature without much difficulty.

For the grinding of cylindrical work such as crankshafts, pistons, wristpins and bearings the company has installed a 20x120-in. Landis grinding machine, shown in Fig. 5 grinding the long end of a crankshaft. Grinding has been adopted on this class of work wherever possible, the chief reason being because of the finish obtained. When the crankshafts were turned to finish size it was necessary to file off high spots, leaving the surface slightly uneven. With grinding, the filing has been eliminated, increasing the quality of the product. The crankshaft shown in the machine is one of the many sizes made, some being twice as large with a greater number of throws. The length is 7 ft. 1 in. and the end diameters are $5.495\ ^{+0.000}_{-0.001}$ and $5.245\ ^{+0.000}_{-0.001}$ in. The time for the complete operation is 160 min. Approximately 0.02 in. of material is removed, necessitating a wheel dressing for the removal of the last few thousandths on each piece.

Another view of the same machine, shown grinding wristpins, is illustrated in Fig. 6. The material of the work is heat-treated high-carbon steel, requiring the removal of 0.03 in. of stock. The diameter is 7 $^{+0.000}_{-0.001}$, with the exception of one end that is ground to a taper of $\frac{1}{4}$ in. per foot. The average time per piece

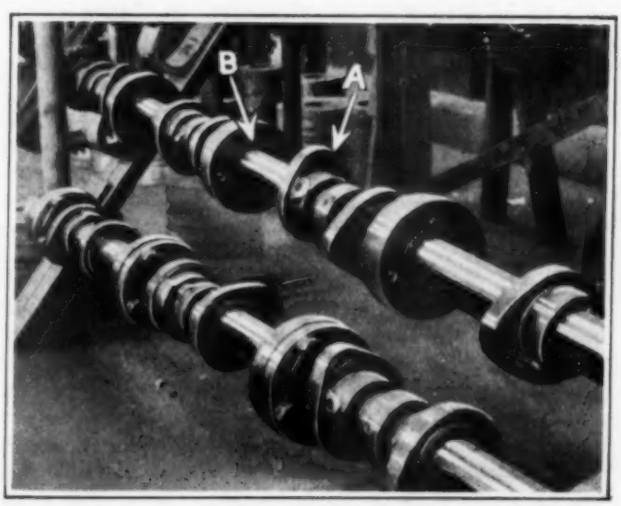


Fig. 10—Camshafts with ground cams

is 110 min., the work being operated at 5 r.p.m. The work is hollow in the center, permitting holding on an arbor with two tapered bushings. At one end the bushing is stationary while at the other end the bushing is slipped on with the work, after which the nut *A* is tightened, holding the work securely in place. Wristpins are made in a variety of sizes from 5 to 11 in. in diameter and are ground on the same machine.

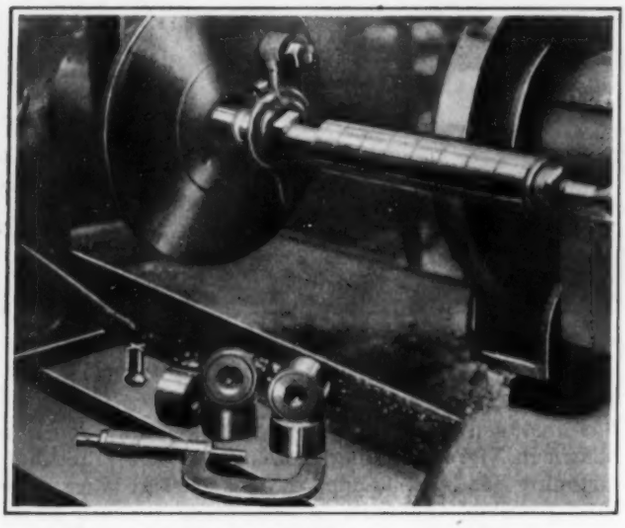


Fig. 11—Finishing diameter of small valves

All pistons made in the shop are finish ground on the outside diameter as shown in Fig. 7. The material is cast iron, the amount of stock to be removed varies from 0.025 to 0.035 in. and the sizes run as high as 24 in. in diameter. The piston shown in the machine is 37⅛ in. in length and is ground to 16.988 $^{+0.000}_{-0.001}$ in. in diameter. A special holding device, resembling the end of a connecting rod, is inserted into the open end of the work and held in place and in alignment by a wristpin. The entire unit is mounted in the machine on centers and finished so that the diameter is true with the wristpin hole. The work is operated at 45 r.p.m. and the wheel used is a 24x1½x8-in., Crystolon 26-J. One dressing is required for each piece. The time per piece is 220 min. The grooved end of the piston is ground slightly tapered.

An idea of some of the work that is ground to size may be seen in Fig. 8. The parts include a variety of pins, shafts, split bearings and pistons.

Grinding Smaller Parts

In addition to grinding large work, there has been a continued increase in the variety of smaller parts that are now ground. Fig. 9 shows the method of grinding cams, the piece in the machine being the fuel-pump cam. It is located by the center hole that has previously been ground to size, 5.125 $^{+0.000}_{-0.001}$ in., and held by two pilots and screws *A* and *B*. The driving head, pivoted on the pin *C*, has on its left-hand side a master cam *D* to correspond with the piece to be ground. A roller operates against the face of the master cam and a weight fastened to the driving head insures a positive contact so that the work follows the true path of the master cam. The speed of the head is 12 r.p.m., the slow speed being used to insure a smooth action between the master cam and the roller. The work is made of tool steel, unhardened, and requires the removal of 0.015 in. of material. The cam is finished to 8.260 $^{+0.000}_{-0.005}$ in., this size being across the highest portion. The time required per piece is 15 min. Micrometers are used for checking the size. The wheel used is 2 in. in width and is fed directly into the 1½-in. face of the work. A number of differently shaped cams are finished by machines of this type. Fig. 10 illustrates a finished camshaft. At *A* is a chilled cast-iron cam while at *B* may be seen the cam shown in Fig. 9. The camshafts are made in a number of sizes and have between 8 and 16 cams assembled to them in addition to gears and worms.

Grinding a Small Valve

Another small part that is ground to finish sizes is the oil-pump valve. Fig. 11 shows the method of grinding the outside diameter. Eight pieces, held on a mandrel, are ground to 1.375 $^{+0.000}_{-0.005}$ in., removing 0.15 in. of material. The production is 100 pieces per hour. The hole is finished to ±0.0005 in. in a previous operation so that the fit on the mandrel is snug, thereby insuring concentricity between the hold and the outside diameter. The width of the face is $\frac{11}{32}$ in. The work rotates at 180 r.p.m. The wheel is a Crystolon 36J and requires dressing for each 10 sets. Fig. 12 shows the same piece set up for the valve-seat chamfer, shown at *A*, that is $\frac{11}{32}$ in. across the widest point and extends into the 0.55 hole. The faces of the valve are also ground to size, the width being held to $\frac{11}{32}$ $^{+0.01}_{-0.01}$ inch.

Fig. 13 shows the method of grinding the apturator, a small spun piece made of $\frac{64}{64}$-in. sheet copper. The outside diameter is ground tapered, being 1.125 in. in diameter at one end and 0.005 in. larger at the other. The width of the face is ¼ in. The work *A* is located on the arbor *B* by its ⅜-in. hole. The indicator *C* is used to centralize the work on the arbor before it is clamped permanently. This is necessary as the hole varies slightly in size and is not concentric with the outside diameter. The indicator is brought up to the work that in turn is revolved and shifted one way or another until the indicator reads approximately zero insuring that a uniform amount of stock will be removed. At *D* is shown a finished piece. The production on this operation is 45 pieces per hour. Each piece is placed in an individual carton after grinding to prevent its being thrown out of round in transportation.

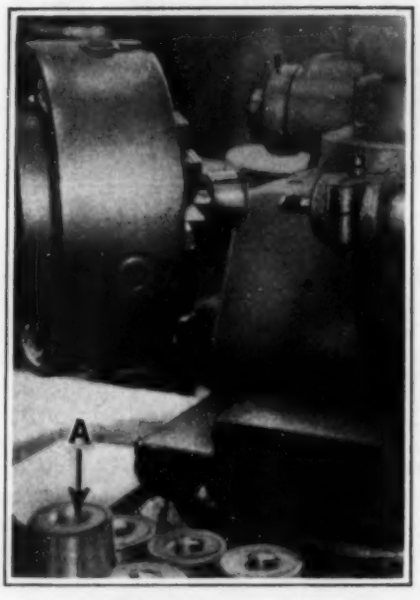


Fig. 12—Grinding seat of valves

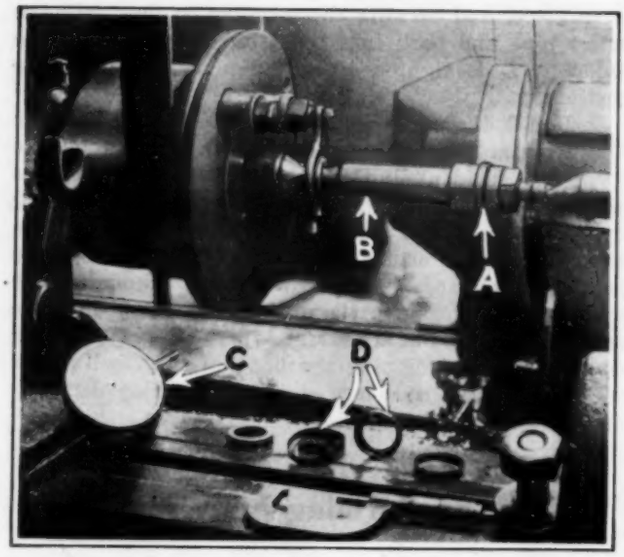


Fig. 13—Grinding tapered diameter of small sheet-copper part

The De La Vergne Machine Co. is including grinding operations only where a decided advantage is to be gained and the work that has been described shows some of the recent adoptions that have aided in not only increasing production but making possible a more accurate product.

Standardizing Grinding Wheels

IN ORDER to impress the designers of grinding machines and attachments with the desirability of recognizing the standards recommended at a recent conference on grinding wheels, we are reproducing the table for internal grinding wheels to be used on new machines, and the table of minimum sizes of grinding machine spindles.

The complete recommendations were published on page 689, Vol. 62, of the *American Machinist*, and have since been adopted at a meeting of wheel makers, machine builders, distributors and users, held under the auspices of the Division of Simplified Practice of the Department of Commerce, Washington, D. C., Sept. 23, 1925. It is suggested that a copy of each of these tables should be kept before every machine designer at all times. Co-operation with the grinding-wheel manufacturers on this point will benefit users, dealers and all concerned.

Table I—Internal Grinding Wheels for New Installations

Wheel Diameter (In Inches)	Arbor (In Inches)	Wheel Diameter (In Inches)	Arbor (In Inches)
¼	⅛	1½	⅜
⅜	⅛	1¾	⅜
½	⅛	2	⅜
⅝	3/16	2	½
¾	3/16	2½	½
¾	¼	3	½
¾	¼	3½	½
¾	⅜	4	½
1	⅜	4	1¼
1¼	⅜	..	..

Thicknesses (in inches)—¼, ⅜, ½, ⅝, ¾, ⅞, 1, 1¼, 1½, 1¾, 2.

Table II—Minimum Sizes of Machine Spindles Given in Inches for Various Diameters and Thicknesses of Grinding Wheels

Diameter	Thickness of Wheel in Inches																
In.	¼	⅜	½	⅝	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5
6	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	1	1	1
7	½	½	½	½	½	½	½	½	½	½	½	½	½	1	1	1	1	1	1
8	½	½	½	½	½	½	½	½	½	1	1	1	1	1	1	1	1¼	1¼	1¼
9	½	½	½	½	½	½	½	½	1	1	1	1	1	1¼	1¼	1¼	1½	1½	1½
10	½	½	½	½	½	½	½	½	1	1	1	1¼	1¼	1¼	1¼	1½	1½	1½	1½
12	½	½	½	½	½	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1½	1½	1½	1½
14	½	½	½	½	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1½
16	.	.	.	.	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1½	1½	1½
18	.	.	.	.	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
20	.	.	.	.	..	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾	1¾	1¾	1¾
24	.	.	.	.	..	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	2	2	2	2	2
26	.	.	.	.	..	..	1½	1½	1¾	1¾	1¾	1¾	2	2	2	2	2¼	2¼	2¼
30	.	.	.	.	..	..	..	1¾	1¾	2	2	2	2	2	2¼	2¼	2½	2½	2½
36	.	.	.	.	..	..	..	..	2	2¼	2¼	2¼	2½	2½	2½	2¾	2¾	3	3

No user of wheels should operate on any machine of given spindle diameter a wheel of larger diameter or greater thickness than specified in the table.

Oil and Repairs—Discussion

BY L. L. THWING

There was an article on page 497, Vol. 63 of the *American Machinist* discussing the relative advantages of having machines oiled by the operator or by a regular oiler. The conclusion reached by the author was that the best results would be secured by giving the job over to the repair gang. Or in the more dignified terminology of today,—to the maintenance department.

The alternative suggestion of having the oiling done between job changes seems to offer more of a problem unless the entire shop actually runs on a real—not a theoretical—schedule, accidents and breakdowns included.

I assume that the procedure in this case would be to have the job clerk or whoever assigns the work, notify the maintenance department that machine number so an so is available for oiling. As a prompt response seems necessary, we must either have a few oilers or repair men on call, like the men in the Underwood emergency repairs advertisement, or word must be gotten to one of the repair men to drop whatever he is doing and hasten to oil up this machine. This does not look so well on paper but it is always well to remember that the man who says this or that cannot be done may be drowned out by the noise of some one doing it.

I am in favor of having each man oil his own machine for reasons different from those previously discussed; for psychological and humanitarian reasons.

Someone has said that one of the best by-products of industry should be men. They should, in fact, be a part of the capital investment and not just an expense to be charged off within twelve months. Monotony of work and the lack of any opportunity to develop a sense of personal responsibility or initiative are an unfortunate part of modern industry.

If a man oils his own machine he has a new job, for a while at least, and he has a chance to learn something about the mechanism of the machine he operates. It gives him a chance to have a bit more of self-respect by being able to do something outside of his routine work. There is not, in general, a marked advantage in either method of oiling so let consideration for the "by-product" swing the scale. Yes, even if he is on piece work.

Testing Hand Fuel-Pumps

CHESTER H. FRANKLIN

Those who read the account of the flight of the round-the-world flyers from Greenland to Labrador may recall that Captain Smith's power fuel-pump went out of commission when his ship was about 300 miles off Greenland, and that his assistant, Lieutenant Arnold, kept the motors supplied with gasoline by a "wobble pump."

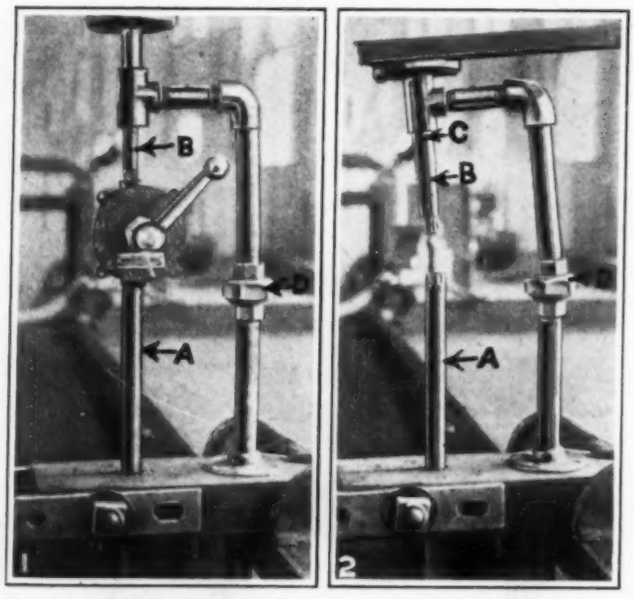


Fig. 1—Testing a wobble pump. Fig. 2—The testing frame or piping

Fig. 3—Clamp for testing the pump body

This device is a hand pump made by the Pioneer Instrument Co., Brooklyn, N. Y. and enables a motor to be supplied in emergencies, by a small oscillating movement of the handle shown in Fig. 1. But when one considers that Lieutenant Arnold "wobbled" this pump for four solid hours, till the ship reached its destination, he must credit both the man and the pump with stamina.

As shown in Fig. 1, the pump is being tested for both lift and capacity, the testing fixture being shown more clearly in Fig. 2. The pump is screwed on pipe *A*, and the upper pipe *B* is screwed into the top or outlet. The hole *C* in pipe *B* is up inside the tee when the pump is in place, and permits the gasoline to flow into the outlet pipe and back into the tank below. When the union at *D* is tightened the pump is held firmly in position.

In Fig. 3, the pump body is being tested for porosity —a necessary test, since gasoline finds very minute openings. Incidentally this view shows a very ingenious use of the C-clamp by the simple expedient of fastening a small pipe on the side and carrying it through the lower end of the clamp. Rubber washers on both the foot of the clamp and on the washer at the end of the screw, make it easy to clamp the pump body in place and apply air or liquid pressure for testing. By using air pressure and dipping the body in the small water tank shown, any leaks are easily and quickly detected.

When a Press Breaks Down on a Forming Job

BY W. EDWARD

When a press breaks down the trouble is almost always sought for in the forming jobs that have been running. Usually, the one set up at the time of the breakdown is blamed. The verdict will be that the operator tried to squeeze too hard or that he endeavored to beat the schedule and make two pieces on one hit, and yet, perhaps something else was at the base of the final failure.

There is another cause for press breakage that is lost sight of in many pressed-steel shops. This cause lies in the press action on blanking jobs, and particularly when there is but a small amount of shear between punch and die.

Assume a piece measuring 10 in. in diameter that is to be blanked in steel of 0.125 gage. The blanking pressure required is $10 \times 3.1416 \times 0.125 \times 50{,}000$ or approximately 100 tons. Allowing a factor of 50 per cent, for shear on the tool, the load is reduced to 50 tons which is actually lower than can be expected since dull tools and continued sharpenings will decrease any calculated gain due to shear in the tools.

In machine design, gradually applied loads are customarily figured with a factor of safety of four to five for proportioning the machine numbers, which is all right so far as building up the pressures to produce the shearing effort is concerned.

When shearing occurs, the release of this built-up pressure is practically instantaneous, a point that few men in press shops appreciate. Good practice for suddenly applied loads calls for a factor of safety of 12 or more in designing machine numbers.

Thus, in the example cited, and allowing 50 per cent for shear, the design factor for building up the pressure to shear should base on 5×50 or 250 tons. On release of this pressure there will be a sudden reversal of load which has practically the same effect as load applied. According to accepted design this should be based on at least 12×50 or 600 tons, which is quite different from the original 250 tons.

Back lash in the gears, lost motion in the crank and pitman bearings and between pitman and ram will give this released pressure opportunity to get in all of its bad effects on the machine members.

To lessen the effect, bearings should be given attention and pitman-cap bolts tightened down. Pitman pins to the ram should, above all, be continually watched and replaced as necessary.

Research in Metal Cutting

By O. W. Boston

Professor of Shop Practice and Director of the Dept. of Engineering Shops, University of Michigan

The discovery of fundamental facts the aim rather than an investigation dealing only with practical results

DURING the last two years an investigation has been conducted in the Machine Tool Laboratory of the University of Michigan on elementary principles involved in the cutting of metals.

This work is proposed by the Manufacturing Methods Committee of the Michigan Manufacturers' Association and has received its financial support directly from industries of the state.

At the beginning it was decided by those interested in the work that the experiments should be confined to an investigation of a basic, scientific, rather than a practical, applied nature. It was felt that the influence of curvature of the surface cut should be eliminated by confining the cuts to straight lines; also that each cut should be of such length that the conditions of cutting

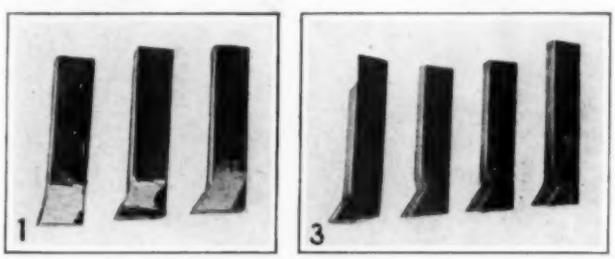


Fig. 1—Tools used in sharpness and clearance investigation. Fig. 3—Tools used in side rake investigation

would be uniform at the instant a reading is taken. In order to secure a straight line cut having a constant cutting speed throughout the stroke, a planer was selected.

The problems undertaken were as follows:

(a) To determine the influence of the degree of sharpness of the tool, as the only variable, on the energy required to remove a given volume of metal.

(b) To determine the influence of the clearance back of the cutting edge of the tool, as the variable, on the energy required to remove a given volume of metal.

(c) To determine the influence of the front rake of the tool, as the variable, on the energy required to remove a given volume of metal.

(d) To determine the influence of side rake (skew), as the variable, on the energy required to remove a given volume of metal.

(e) To determine the influence of the depth of cut or width of cut, as the variable, on the energy required to remove a given volume of metal.

All tools used in these tests are of the cut-off or end cutting type, and the material to be cut is prepared to present a land equal to the width of the chip indicated, the depth being equal to the vertical feed of the tool. This gives a chip, the cross section of which is a rectangle.

Some tools prepared for the tool sharpness investigations, Problem (a), appear in Fig. 1. These tools have a clearance angle of 4 degrees, with front rake angles, starting from the left, of 10, 20 and 30 deg., respectively. The same tools, each with various clearance angles, were used in the clearance investigation, Problem (b).

The tools prepared for the front rake investigation, Problem (c), are shown in Fig. 2. These tools have a clearance angle of 4 deg. and a front rake angle, starting from the left, of 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 60 and 75 deg., respectively.

Four tools prepared for the side rake investigation, Problem (d), were photographed to make Fig. 3. Each of these tools has a 4-deg. clearance angle and a 30-deg. front rake angle. The side rake angles are 0, 10, 20 and 30 deg., respectively, beginning with the tool at the left.

Other tools having front rake angles of 0 deg. and

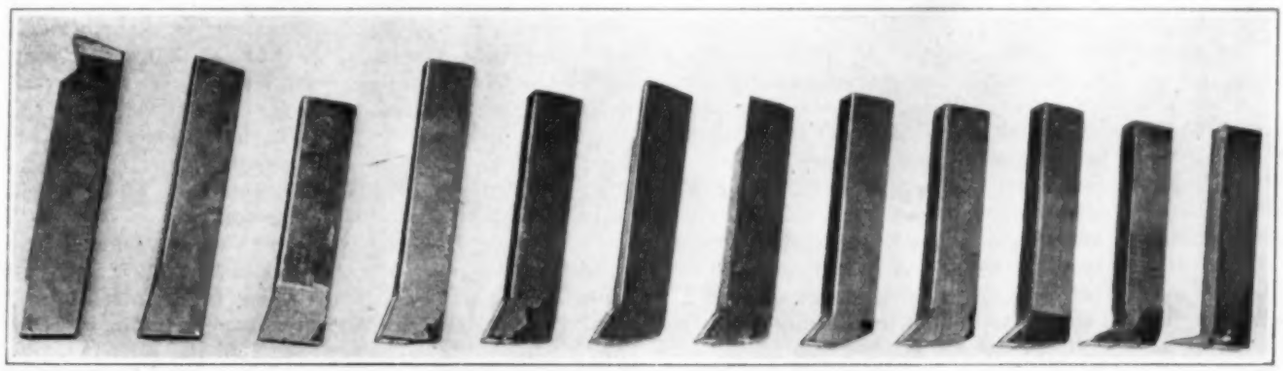


Fig. 2—Tools used in front rake investigation

side rake angles of 0, 10, 20, 30, 45, 60 and 75 deg., respectively, are also prepared.

A Liberty, 30-in. x 36-in. x 8-ft. planer was selected for the work. The power is furnished from a main drive shaft. A specially designed dynamometer is mounted on the table. The dynamometer consists essentially of a bed *A* mounted on seven horizontal knife edges which permit motion of the bed in the direction of travel of the tool. At the left end of the dynamometer bed is a series of vertical knife edges supporting levers *B* which transmit the force on the tool to a piston in the chamber *C* which in turn transmits the pressure through a water medium to the differential mercury column gage shown in the foreground. The column is graduated to give a direct reading of the force on the tool. Side motion of the dynamometer bed is prevented by the floating pins *D*, two of which are mounted on each side.

At the far end of the dynamometer bed is seen a loop spring. This is calibrated on a Riehle tensile testing machine and is under a compressive strain giving a 2,000-lb. initial load as registered on the indicator. The object of this initial load is to take up all slack and to prevent chatter. On the bed of the dynamometer is shown a bar of 0.15 carbon, open-hearth steel, fully annealed, 4 in. high, 6 in. wide and 4 ft. long. The lands, ½ in. wide, are shown on its top surface. The tool is in its proper position in the planer head. The vertical feed of the tool is measured by the dial indicator mounted on the right side of the head.

The material cut was 0.15 carbon steel, 0.40 carbon steel, 1.00 carbon steel, S.A.E. 2320, S.A.E. 2345, S.A.E. 3120, brass and gray cast iron, both annealed and unannealed.

For the different problems, chips have been removed varying in width from ⅛ in. to 1 in.; in depth from 0.003 in. to 0.100 in. The speed in all cases has been kept constant at 20 ft. per min. In several instances these data have been checked with those for a speed of 35 ft. per min.

Complete chemical and physical properties of all of the materials have been obtained. It is hoped that some relation between certain of these properties and the force required on a tool to remove a particular chip will be found.

The experiments have been concluded. The data are now being summarized and interpreted in the form of a final report. At the present time, a plan for future work is being considered. It is hoped that experiments of a fundamental nature may be continued.

The writer has been interested in hearing and reading frequent criticisms on research work of a fundamental nature in cutting metals. It is true that sums of money have been spent in conducting experiments of an elementary nature, yet this is probably only a small percent of that which has been spent for work of a more applied nature. Today definite information as to the action of a tool when cutting is not available.

An editorial in the Feb. 6 issue of *The Engineer* on "The Philosophy of Cutting" encourages investigation of a scientific nature in metal cuttings. The Institution of Mechanical Engineers in England now sponsor a great deal of research work of a fundamental nature. It was only after some of their members showed a tendency to criticize the work on the ground of its not being of sufficiently practical nature to be of value to engineers that Dr. T. E. Stanton of the National Physical Laboratory wrote a letter to the editor of *The Engineer* from which the following is taken:

"I venture to think that this attitude is due to imperfect acquaintance with the history of the Cutting Tools Research Committee of the Institution.

"This committee was formed in 1919, and a research program on practical lines, involving the formation of some six panels, each of which would deal with a particular method of cutting, was drawn up by a subcommittee appointed for the purpose and approved by the main committee in 1920. Later in that year, however, a memorandum by Mr. William Taylor, member of Council, was submitted to the committee, strongly urging the importance of a preliminary study of the "fundamentals" of cutting action, or, in other words,

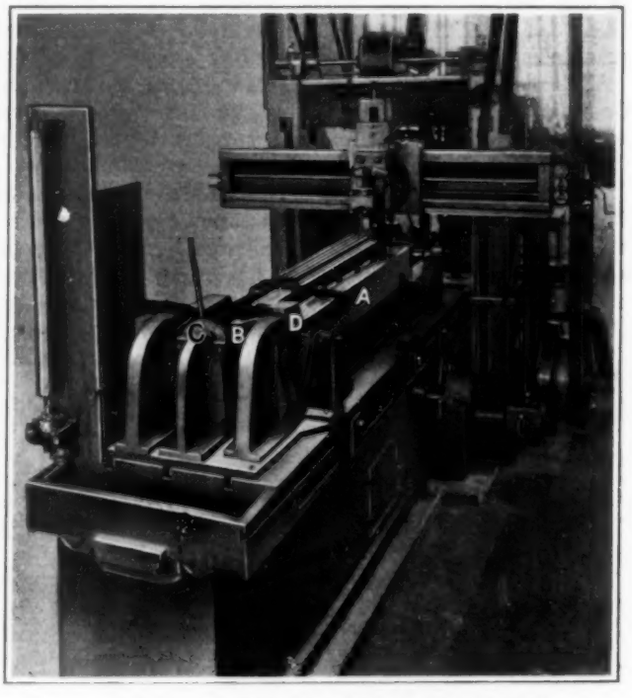


Fig. 4—Dynamometer mounted on Liberty planer

proposing that before entering upon a research on the admittedly complicated actions which constitute metal cutting under modern works conditions, some addition to our knowledge should be obtained as to how a tool cuts and why a tool cuts. It will be clear that this proposal was of a somewhat revolutionary character for the Institution to adopt, since it involved changing the nature of the research from that of an *ad hoc* investigation on cutting tools to the study of the fundamental action of cutting, which might be regarded by some as the highest form of engineering research, and by others as a branch of mechanical philosophy with which the mechanical engineer was only remotely concerned. The result of the memorandum was that the main committee approved Mr. Taylor's proposal, and set up a Sub-committee on Fundamentals, and the papers discussed before the Institution on Jan. 23 described work undertaken for this sub-committee.

"Without wishing to enter upon a discussion of the wisdom of the step taken, I should be glad if you will allow me to bring the above facts to the attention of your readers, as I think that an appreciation of them will go far to meet the criticisms on the reports which have been made."

Automotive Production

Multiple-Drilling Operations in the Studebaker Plant

By W. F. Sandmann

Drilling the engine crankcase—Using the multiple drill on small parts—The use of rotating-table set-ups — Inverting the multiple drill

A LARGE portion of the machining in automobile manufacturing consists of the drilling, reaming and tapping operations. Many crankcases contain nearly a hundred holes, cylinder heads more than fifty, and other motor parts such as rocker arms, flywheels and gear covers, have between one and twenty-five holes to be drilled and tapped or reamed. So the drilling problems loom very large when the specifications for the machinery and tools to build a new automobile motor are being prepared.

The Studebaker Corporation, South Bend, Ind., went into the drilling problem very thoroughly when equipping its plant, and multiple drills were, of course, used wherever possible, not only on the parts containing many holes, but also for only one or two holes where the design of the part made it possible to effectively set them up together.

There is more room for ingenuity in the design of jigs and fixtures for multiple drills than for any other machine. The Studebaker engineers co-operated with the engineers of the Natco multiple drilling machines in the design of the tool equipment.

The crankcase line contained several two- and three-way drilling and tapping machines. Fig. 1 shows the three-way machine for drilling the holes in each side and the bell end of the crankcase in one operation. It will be noticed that the spindles are all of the adjustable type so that if any change is made in the crankcase design, the spindles can be changed wherever necessary. At *A* and *B* can be seen the cluster plates which provide a support for the spindle arms without making it necessary, in order to bolt them, to extend individual clamps to the T-slots around the outside of the heads. These cluster plates are the only portions of the heads that were made for the particular job assigned to the machine, but they are only heavy, flat cast-iron plates with holes drilled in them for the spindles and clamping bolts. They can be replaced at a small cost if the work is in any way changed.

The fixture holding the crankcase was designed to slide on ways to facilitate loading and unloading when the operator has finished each job. The crank *C* operates a sprocket and chain arrangement for moving the fixture in or out. The crankcase slides endways into the fixture from the conveyor and is clamped down by the handwheel on the top. The crankcase is located in all the fixtures by means of dowels fitting into two small holes that were drilled and reamed in opposite ends of the flange in the first drilling operation.

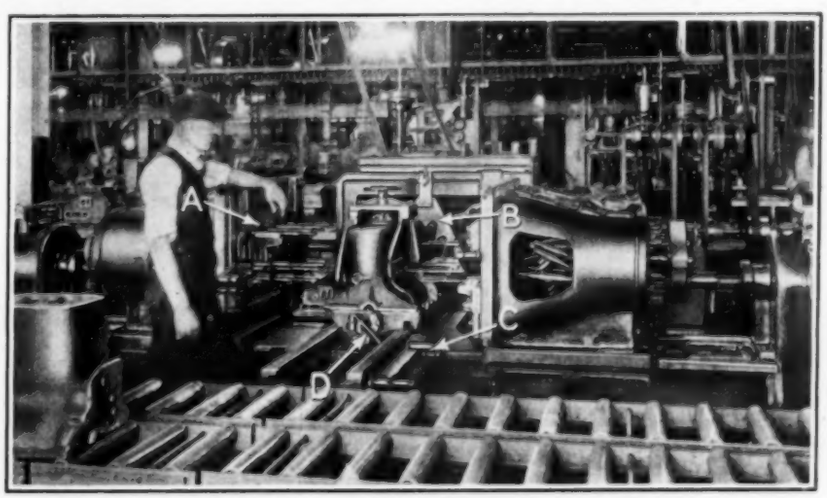


Fig. 1—Three-way drilling of engine block

The next ma-

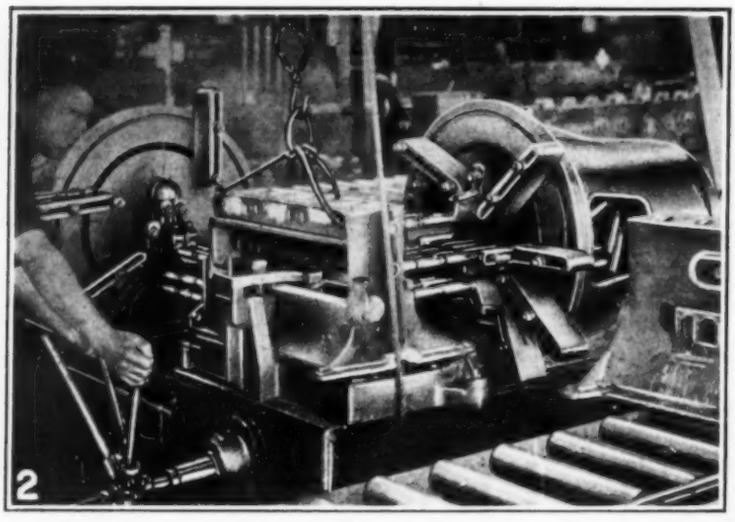
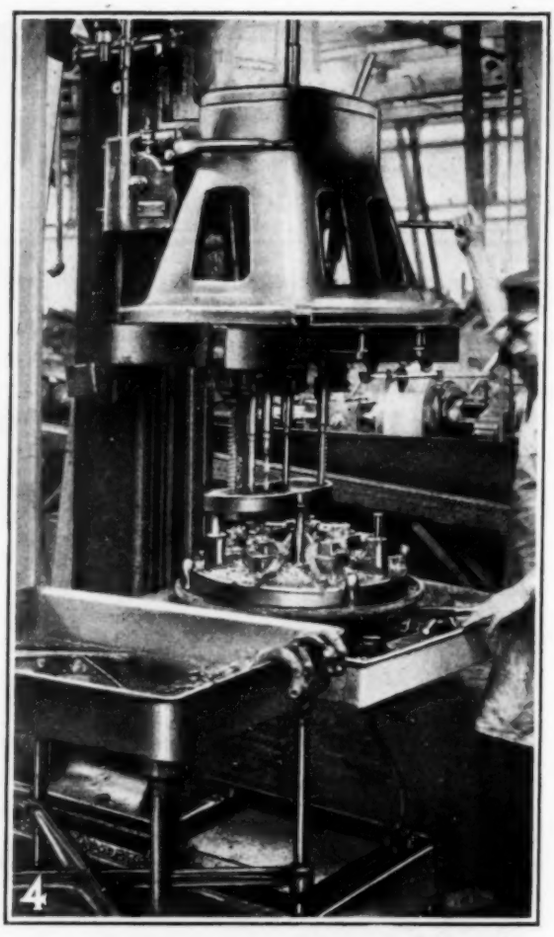


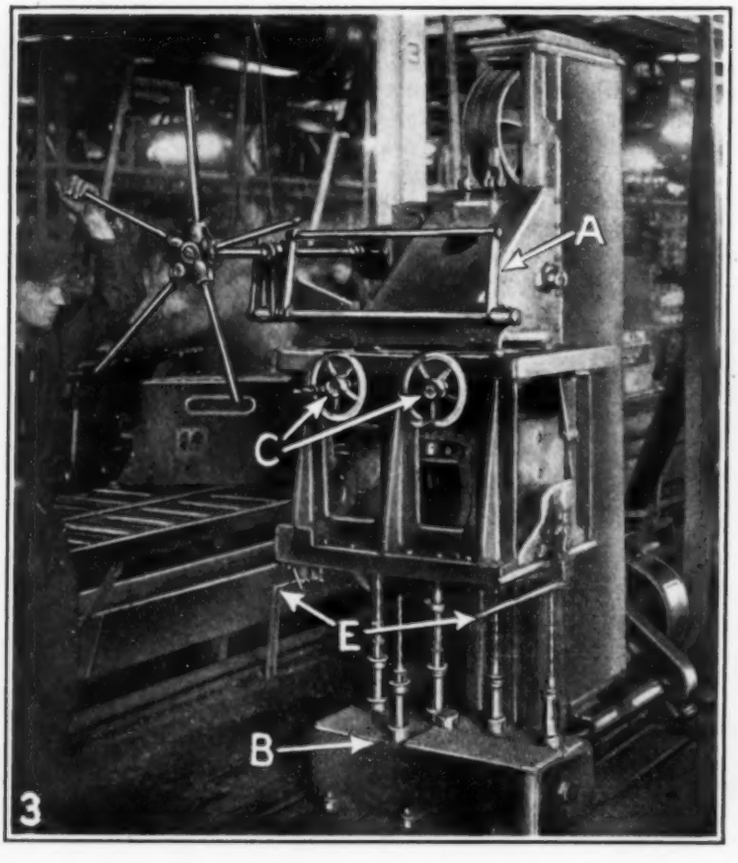
Fig. 2—Drilling and tapping on two-way tapping machine

Fig. 3—Inverted multiple drilling machine

Fig. 4—Multiple drill used for production of small parts

Fig. 5—Rotating table used on multiple drill





AUTOMOTIVE PRODUCTION

chine in the line is illustrated in Fig. 2. This operation consists in the drilling and tapping of a number of holes in one side and the bell end of the case on a two-way Natco tapping machine. The fixture in this operation is very simple and consists of merely a base and a suitable clamp. The taps are drawn in by means of the handwheel and the spindles are automatically reversed at the proper depth, backing out the taps.

A standard Natco multiple-drilling machine is shown in Fig. 3. The table, however, has been inverted and placed in the position that the head would normally occupy at *A*, and the drills extend upward from the box at *B*. This very unusual arrangement was made necessary in order to drill five deep oil holes in the bottom of the case. It was decided that the chips would clear better if the drills were inverted. The holding fixture is suspended from the table. The case slides into the

Fig. 6—Drilling and reaming on the same machine

fixture from the end and is clamped down by two wedge-type clamps operated by the handwheels at *C*. The two levers at *E* are used for pulling down the dowels so that the case can slide over them into the fixture.

The remaining operations consist in drilling the holes in the bottom and the top of the casting, and these holes are easily taken care of in the ordinary way by setting the case on the milled face and drilling all the holes in the opposite surface by means of a multiple drill. The tapping, where necessary, was handled in a similar manner.

Some of the smaller motor and chassis parts make ideal rotating-table set-ups. Fig. 4 shows a small rotating-table outfit in which the brake and clutch pedals are drilled. The drill bushings are carried in a bushing plate suspended from the head of the machine. At each indexing of the table, this plate is located over dowels on the fixture. The fixtures at the front of the table are always open and accessible so that the finished pieces can readily be loaded and unloaded.

A slightly more elaborate set-up is shown in Fig. 5. This machine was used on a part of the clutch, containing twenty holes. On account of the proximity of the holes, it was found advisable to arrange the set-up so that three passes were made with the drills and a third of the holes finished each time. Since there are three clutch parts being drilled each time the head comes down, after each operation the operator removes from the fixture a completed piece. The suspension plate arrangement was used also with the set-up.

The drilling of a bracket is shown in Fig. 6. It was necessary, in this operation, to maintain a very heavy flow of cutting compound and a very efficient set of splash guards, surrounding the rotating table, protect the operator. This operation consists in drilling and then reaming four holes. After drilling the four holes, the operator rotates the table 90 deg. and finishes the holes with the four reamers at the right. At each downward stroke of the head, the operator removes a completely drilled and reamed piece.

The rotating table with suspended bushing plates was used on many multiple drills in the plant. In some cases, similar to that shown in Fig. 6 it was found more practical to incorporate a set of bushings in each jig.

Since fully adjustable, multiple-drilling equipment is used almost entirely, there is never any likelihood that it will become necessary to discard a battery of multiple drills because of engineering changes in the motor and chassis parts.

Brake-Lining Standards

In December, 1924, a conference was called by the Division of Simplified Practice in the city of Washington on the simplification of brake-lining. At this conference the Society of Automotive Engineers was asked to submit a limited series of brake-lining sizes which would be satisfactory for new equipment and for servicing automobiles now in existence.

Using the present S.A.E. standard as a basis, a recommendation has been developed by a subdivision of the parts and fittings division covering 25 sizes of brake-lining. These sizes, in inches, run from 1½x¼ to 6x⅜.

The additional sizes proposed are deemed desirable for existing equipment, with the exception of the ⅜-in. sizes, which are included in anticipation of motor-coach development.

An analysis of production figures for 1923 and 1924 indicates that the recommended sizes represent over 80 per cent of the total production and that no sizes that are not listed represent a production of over 1 per cent. The list of 25 sizes, if generally adopted in future practice, would mean the elimination of over 100 sizes. It is anticipated that this list will serve as a basis for stocking brake-lining by dealers.

The report, when approved by the society, will be transmitted to the Division of Simplified Practice for consideration at a general conference for adoption as a recommended simplified practice.

AUTOMOTIVE PRODUCTION

Abstracts

from other publications

Labor Costs

Fewer men per unit of production are being used in automotive manufacturing today than ever before, according to a survey made by Norman G. Shidle. Within the last two years, reduction in the number of workers needed to build a given number of vehicles or parts ranges from 10 or 15 per cent to as much as 50 or 60 per cent. Among the chief factors contributing to it are: first, improvement in factory methods and installation of more labor-saving machinery; second, working out of group methods of incentive wage payment which have made it profitable for the individual worker to have as few men in his group as possible; third, changes in vehicle construction designed to simplify production and manufacturing problems.

Since individual earnings have increased only slightly and since the number of men per unit of production has been decreased materially, it is evident that automotive labor costs have decreased materially in the last year or two. Investigation of wage trends in the automotive industry indicates that manufacturers in general have taken a sound psychological path in their attempts to reduce labor costs. They have sought decreases through improved methods of handling material and performing operations so that one man can do more work without decreasing his accuracy and precision.

An example is given of a large plant which in 1923 employed 3,898 men and produced 3,819 cars or 1.021 men per car. In May 1925 4,428 men were employed and during the month 4,721 cars were built or an average of 0.938 men per car. One important axle manufacturer uses 40 per cent less men per unit of production today than he did in 1923, while a new car producer employs only 10.7 men per unit of production as against 17.9 men per unit a year ago.—*Automotive Industries*, Sept. 10, p. 401.

Vauxhall Manufacturing

The Vauxhall shops in England are laid out on modern lines and every machine is equipped with individual motor drive. The countershaft and cone pulley for each machine are on a pedestal, which, together with the driving motor is situated at the rear of the machine. The chassis assembling is on a chassis track system and a 14-hp. chassis is assembled progressively, a bare frame being converted into a finished chassis in approximately 9 hours at 9 different stations.

Many special machine tools are used, the policy being that although in many cases the relative small output is insufficient to keep a special machine engaged for more than a few working hours per week, yet the improved quality of the work and also lower operating costs more than offset any inefficiency arising from idle equipment.

A unusual system of payment is in vogue at the plant. A system of efficiency pay has been adopted which takes into account both quantity and quality of work. The quantity of work that a man turns out is mainly a measure of the company's efficiency in management and quality is in a measure the means provided for him to do that work. They, therefore, pay to each man the grade basis rate plus a supplement stated in terms of percentage upon the rate in accordance with the estimate of the individual's whole value to their policy.—*The Automobile Engineer* (England), Oct., 1925, p. 341.

Heat-Treating Axle Shafts

The Hudson Motor Car Co. thoroughly anneals its rough axle forgings before sending them to the machine shop. By this process they have practically eliminated the warping during the hardening process which heretofore had made the grinding operation difficult. The annealing furnace is of the pusher type and is 24 ft. long. A pusher bar moves forward and shoves the work through the furnace, the units being placed on trays made of cast iron about 1 in. thick. These trays form a continuous hearth sliding over rails.

The hardening or quench furnace is electrically heated. Seven overhead ribbon resistors placed in cast alloy frames and porcelain insulators extend over the entire length of the hearth. Current is supplied from a three-phase line at 220 volts and the power consumption is about 190 kw. Material is advanced through the furnace by a pusher similar to that on the annealing furnace but the shafts are not placed in trays, being carried one at a time along the furnace track on special holders.—*Fuels and Furances*, Sept. 1925, p. 985.

Aircraft Engine Lightness

The Napier Lion engines which were used in the contest for the Schneider Trophy are rated at 450 hp. They are of the 12-cylinder type, arranged in three blocks of four cylinders each and actually develop 470 b.hp. at 2,000 r.p.m. and weigh approximately 2 lb. per hp. As indicating the amount of skilled work necessary in the manufacture of this engine the following figures give the rough weight, finished weight and number of operations. The master connecting rod weighs in the rough 24½ lb., finished it weighs 5¼ lb. and in its finishing there are 75 operations; the crankshaft weighs 156 lb. in the rough and 47 lb. finished in 60 operations; the crankcase weighs 150 lb. rough and 90 lb. finished in 80 operations; the cylinders weigh 100 lb. rough and 10 lb. finished in 50 operations.—*Aviation*, Oct. 26, p. 586.

Air Transport Engineering—Exclusively

That air transport is no longer a dream is shown by a neat folder with the above title, recently issued by Archibald Black, Garden City, L. I., who occasionally contributes to these columns. With the fifteen years' experience in aircraft engineering behind him making him one of the pioneers, he now makes route surveys, analyzes traffic, advises on investment, operating cost, ground and flying equipment, organizes operating forces and has at hand data on plane design, materials, equipment, supplies and construction.

Railroad-Shop Practice in the Far West

By Frank A. Stanley

Advantages of internal and external grinding—Fixtures for machining crown brasses—Milling teeth in reversing-lever quadrants—Truing worn crankpins by filing

WE HEAR a great deal these days about the use of the grinding machine in the railroad shop, and unquestionably its advantages are such as to warrant its extended applications to further operations that are at present handled by other means. There is one advantage in the grinding process that is not so commonly referred to as it might be, but which is especially important in connection with railroad shop operations, namely the saving of material during the finishing of parts and the consequent increase in the ultimate life of such parts.

Consider for a moment the relative conditions under which a job is handled by means of a cutting tool or by a grinding wheel. Where a surface is to be re-turned or a hole rebored, a certain amount of metal must necessarily be removed in order to keep the point of the turning or boring tool under the surface. That is, there is a certain definite, minimum amount of metal that has to be taken off the low side of the work in order that it shall be trued up properly, and usually this means something like $\frac{1}{8}$ in. of stock to skim up the job. In the case of cylinders for air equipment and similar work, where the sections are comparatively thin, the exact amount of metal that has to be removed in reboring is of real importance, for too deep a cut means a correspondingly short life for the casting.

Grinding Lessens Waste

With the use of the internal grinding wheel, however, the bore can be refinished with practically no loss of metal on the low side, adjustment being made so that the wheel will just cut at the point of greatest wear in the hole, and then true up the whole bore to cylindrical form. With reasonable care in setting up the job, a worn air cylinder may be reground a number of times with little waste of material, where at least an equal amount of stock would be removed by one reboring operation alone. This saving is aside from the question of finish, which usually is obtained most readily by the grinding process, while with boring operations, a fine finish is a far more serious undertaking. Nevertheless, the quality of the finish in a bore of this character has much to do with its wearing qualities and with its satisfactory operation, so the grinding process results in other advantages beside the one of adding to the normal life of the job.

We are considering here entirely unhardened work, which can be finished either by abrasive wheels or by cutting tools, and which is still the subject of considerable controversy as to the best means of handling.

Another job along this line is the reboring or regrinding of rods for bushings, where brasses have become worn and have pounded the holes in the rods somewhat out of round. To rebore these holes, means either setting the job on a horizontal boring mill, or the use of special fixtures and boring heads under a heavy vertical drill. Either of these processes is sure to result in enlarging the hole more than is actually necessary to true it up, thus reducing the steel section unnecessarily and requiring the use of a brass of correspondingly larger diameter.

But with the grinding of such work, the job is greatly simplified as indicated in Fig. 1. Here the rod is shown secured to a plain, angle form of fixture with three flat straps to clamp it in place. The outer end is carried on a rest of suitable height. The wheel, about 5 in. in diameter, is shown in contact with the work, and it is evident that the hole can be trued up by the minimum removal of stock.

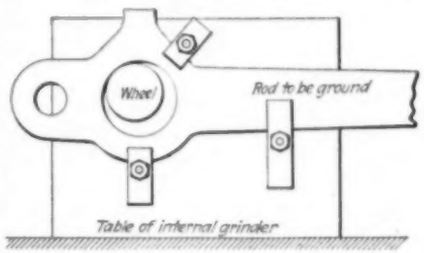


Fig. 1—Side rod set up for grinding

The table of the planetary grinder is 36 in. long, the rod itself measuring about 6 ft. over all. With the job as shown in the sketch, the wheel was run at about 2,500 r.p.m. The rod is $4\frac{1}{2}$ in. thick, and the time required for feeding the wheel through the hole was less than one-half minute.

An entirely different type of job found in the railroad shop is the grinding of the curved slots in links. The link slot has a length from end to end of the arc of about 22 in. and a width of $2\frac{3}{8}$ in. The body is 2 in. thick. The slot-grinding operation is accomplished in some shops by a form of vertical-spindle grinder, having a radius control for the table action. The work is supported on an auxiliary table that can swivel on the main reciprocating-table of the machine. The length of the radius to which the arc is to be ground is determined by an adjustable bar, pivoted on an outboard support several feet away from the front of the grinder.

As the grinder table is operated to and fro, the pivoted table with the link, is swung upon its axis so that the actual path of the link center is along a curved line, the radius of which is fixed by the position of the pivot at the outer end of the radius bar.

The work is performed by a 2-in. grinding wheel carried at the lower end of the vertical spindle of the grinder. Owing to the restricted diameter of the wheel, the mount is also limited in size, but ordinarily the amount to be ground out of the slot is not great and the work can therefore be carried forward under good headway. The table reciprocates at, say, 15 forward and back strokes per minute or at an approximate rate of

30 ft. cutting speed per minute. The amount removed on a side is from 0.010 to 0.012 inch.

Turning to another line of operations, Fig. 2 illustrates a method of machining crown brasses recently noticed at the Southern Pacific Shops at Sacramento. Here, two rotary fixtures are shown on a planer with a pair of brasses being finished at the same time. The

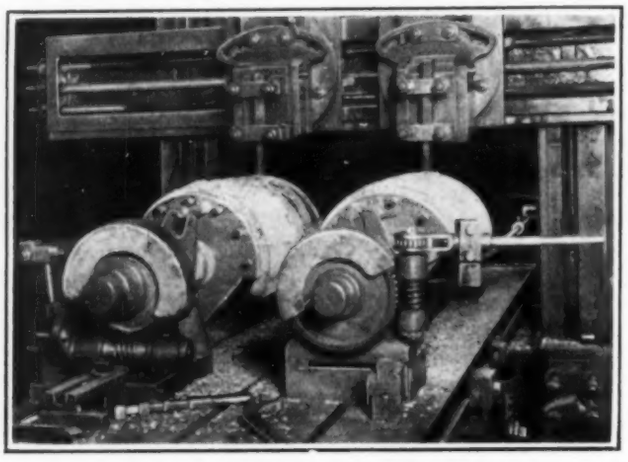


Fig. 2—Machining crown brasses

feed for rotating the work at each stroke of the planer, is by means of links connected to the ratchet levers on the worms.

The practice in planing the fit for the driving box is to use a special gage in the interior of the box where it is slotted out, and then allow in the shaping of the brasses about 0.015 in. along the edges of the brass for pressing in. That is, the brass if measured around its curved shell would be longer than its seat in the box by about 0.030 inch.

It has been found in practice that this allowance will provide for about 25 to 30 tons pressure for forcing the brasses into the boxes.

One more operation of interest at the same shop is shown by Fig. 3. This view represents the milling of teeth in reverse-lever quadrants, using a gear cutter for

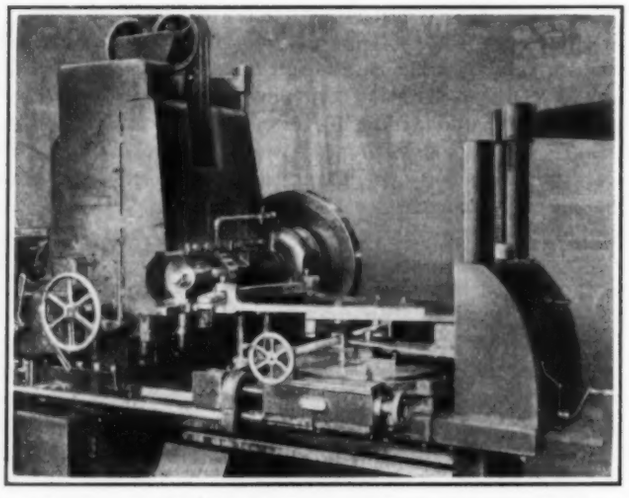


Fig. 3—Cutting teeth in reversing-lever quadrants

the purpose. The cutter shown is of the multiple type for forming several teeth at one pass across the work.

The method of mounting the quadrant for notching, is to secure it on a special fixture consisting of a pivoted frame with adjustable arms to suit the radius of the quadrant to be cut. The work is secured by clamping it in the jaws shown at the end of the fixture arms, the adjustment of the fixture and work for each cut to be taken being secured by means of the handwheel and screw under the frame of the fixture. The cross-screw is journalled in bearing blocks at opposite sides of the fixture base, and passes through a long nut under the center of the device. This nut is connected by a link with the fixture arms, and movement of the nut is followed by corresponding movement of a greater degree by the fixture and work.

The quadrant seen in the view is of 37-in. radius. Such quadrants may range in pitch from $\frac{1}{4}$ to $\frac{1}{2}$ in. With the former pitch eight teeth are cut at once; with the $\frac{1}{2}$-in. pitch, two teeth are cut simultaneously.

The unequal wear imposed upon bearing surfaces of various kinds, causes one of the peculiar problems of upkeep in locomotive shops. If all worn surfaces were to be restored to cylindrical form by a cutting-tool process, reduction in size of pins and increase in diameter of bores would be more marked than at present. This is especially true of such details as crankpins. The flat spots and uneven surfaces on the pins as worn in service, present an attractive opportunity for bringing them to form again by some cutting tool or other. Here again the question of removal of stock is quite apt to come to the surface, and not infrequently the only tool resorted to for the purpose of truing up a pin, is a file in the hands of an experienced mechanic.

It is surprising to note the skill displayed and results obtained under this process. Naturally the file removes the least possible amount of metal required to bring the pin to working shape again. The truth obtained in the way of a round, parallel pin is easily checked by calipering around its circumference and along its length. It has been suggested that here would be an economical application of the grinding process, using an attachment made to carry the wheel around the pin, so that slightest contact possible would insure a truly cylindrical surface.

Controlling Time Changes in Steel

Everyone knows that steel expands and contracts with changes in temperature, but aside from these changes we ordinarily think of anything made of steel as unchanging in dimensions, except of course when the metal is actually worn away.

However, steel undergoes dimensional changes, some of which are produced during the tempering processes which form a part of many manufacturing operations, while others occur as the steel "ages" with time. These changes are of sufficient magnitude to be of real concern to makers of precision gages and users of these tools.

The Bureau of Standards of the Department of Commerce has been investigating the changes accompanying tempering and aging of tool steels and has discovered that in tempering, changes in length occur in three distinct stages depending on the quenching temperatures and rates of cooling. The changes with time also are results of the changes produced by tempering, the contraction with time being identified with the initial contraction produced on tempering, and expansion with the expansion which follows the initial contraction, produced by the tempering.

From these correlations, the bureau has secured information concerning the control of the time changes in tool steel.

A Plea for the Machine Tool Industry

By J. R. Kraus
Vice-President and Executive Manager, the Union Trust Co.
Cleveland, Ohio

PROBABLY the most startling advance made in the last half century has been along the line of invention, manufacture and adaptation of machinery for a variety of purposes. It has revolutionized production, transportation and our entire method of living. There is one particular line of industry without which development of mechanical processes would have been impossible. I am referring to the machine tool industry. Without the machine tool, it would be impossible to have any other tools whatever. Without machine tools, it would not have been possible to have electric power, gas-propelled vehicles, radio, telephony, and so on.

I am stressing this fact because, for men engaged in other lines of business—men who deal with a product itself rather than with its production—it is often difficult to see the essential relationship between their own success and prosperity and the success and prosperity of the machine tool industry. A man who sells fertilizer, for instance, might not understand that without the machine tool industry, he would have no market. It would nevertheless be true, for without machine tools no agricultural implements would be built and, consequently, there would be no market for fertilizer. The calculating machine salesman, dealing with auditing and bookkeeping departments, may not think of the machine tool trade from one year's end to the next. Yet it is essential to his very livelihood. So this industry, though small, affects a field of an amazingly large scope.

Obsolete Machinery Loses Profit

Failure to sense the essential nature of machine tools is particularly evident upon the part of men engaged in the marketing and financial end of many manufacturing businesses. Bearing in mind the lesson taught by the inflation and depression following the war, these men are loath to spend money—an attitude which is creditable enough itself, but which sometimes defeats its own purpose. In other words, the use of obsolete or worn out machinery may actually cost a plant much more in the long run than the outright purchase of new machinery of a more efficient type.

In fact, looking at it from a positive rather than from a negative point of view, the purchase of new machinery may decidedly add to the net profits of a plant, and this increase in net profits may be quite definitely figured in advance. This may be done by calculating the amount of time saved by the new machines contemplated, translating that amount of time into terms of dollars saved (making due allowance for depreciation of the new machines during one year, and also for the second-hand value of the old machines) thus obtaining an accurate estimate of how much the purchase of the new machines will add to the net profits in one year. Applying this final figure to the cost of the proposed new machines will also give the probable percentage of return on the investment. On the basis of standard production throughout the year, a number of actual estimates of specific replacements give surprising figures. For instance, in a certain factory, one replacement reduced the time on one operation from forty-three minutes to eighteen minutes. The investmnt for the new machine was $4,100. The saving per year—that is, the actual addition to net profits per year—was $3,494.40, making the annual per cent of return on the investment, 85.2 per cent.

It is only natural that men whose experience and interests have lain in the financial and marketing end of their businesses should be unable to see why a steel machine, firm and solid to all appearances, which has been in operation for, let us say, fifteen or twenty years, should not continue to operate for another fifteen or twenty. Interested primarily in getting immediate returns out of their businesses, these men dislike to face the problem of replacement of machinery, with its attendant expense. They blue-pencil contemplated expenditures in this line, shutting their eyes to consequences.

This attitude may be due to a lack of actual experience in the shop, with a consequent inability to understand the true situation.

The factory manager would not think, of maintaining such an attitude toward his automobile or his radio, or any other piece of machinery with which he is familiar by personal use. When he purchases an automobile he takes it for granted that within three or four years it will be worn out. He does not think that simply because it is an automobile it may continue to run for four or five years more. In the case of radio, for instance, he well knows that a two-year old set has become obsolete and that replacement by a newer or better type is necessary to effect the result which he desires. And yet, when it comes to machines such as millers, planers, lathes and the like, executives are inclined to say "no" to the first suggestion of replacement, regardless of the age or degree of obsolescence of the machine.

Better Inventors than Financiers

This attitude, together with a number of factors within the industry itself, has made the machine tool trade particularly susceptible to the ups and downs of business—more so, I believe, than should be the case with an industry of such a basic nature. One factor within the trade which has led to the situation is largely one arising from the nature of the very work which the industry performs. Inventive genius is essential to the machine tool trade, and inventors are no more financial geniuses than financial geniuses are inventors. The very fact that men in the trade must be highly skilled scientifically and technically is perhaps the reason that they have suffered in many cases through inability to finance and distribute efficiently. The machine tool man has been a better inventor than he has been a business man. The machine tool industry has not always insisted upon sufficient

Abstract of an article published in *Trade Winds*.

profits to carry it through ups and downs, good years and lean ones.

While business is business, nevertheless, considering the fact that the machine tool trade is essential to all of the lines of industry, it seems possibly short-sighted, to say the least, to barter too closely with a trade upon the prosperity of which manufacturing is so vitally dependent.

May I suggest that the purchaser should view the price of a machine tool in the light of its usefulness and the inventive genius that has gone into its construction, rather than solely upon the per-pound basis. Brain work cannot be sold by weight, and the machine tool trade should secure always an adequate return upon the scientific and the mechanical skill and learning necessary to the manufacturer of its product.

Suppose depreciation on machine tools is figured on the basis of 10 per cent per year, thus spreading the cost of machine tools on the books of the company over a longer period of time than that usually allowed them, in such case it must be borne in mind that this depreciation is actual and not theoretical, and the depreciation account should be carried as an actual cash account and not merely as a book item.

Financial Security on Paper

Let us assume that in one certain year a plant starting out with $200,000 in new machinery, should plan to charge off 10 per cent a year for depreciation and at the end of seven years has charged off 70 per cent of the original cost of this machinery; that is, $140,000. The question is, "Does this company, at the end of these seven years, have $140,000 in cash set aside to meet replacements?" Unfortunately, this is not usually the case. The depreciation reserve exists only upon the books of the company and is not provided for in a reserve bank account or in securities. Of course, this is a purely hypothetical case given merely for purposes of illustration. Few plants start operation with all new machinery and few going concerns, actually setting aside cash to offset depreciation, would allow all of this cash to remain unspent over a period of seven years. Instead they would gradually begin spending this cash for new machinery, meeting depreciation and making replacements from time to time as demanded. In any event the 10 per cent depreciation allowed for would be offset either by a cash reserve or through actual replacement by new machinery. But if a company's depreciation account is merely a book account, it will soon become only too evident that the depreciation "charged off" has been utterly meaningless and the company will be face to face with the task of raising cash immediately for the purchase of new equipment. Only by offsetting depreciation by either a cash reserve or the steady replacement of old and obsolete machinery by new, will a company be in a position where it will not have to resort to extraordinary or outside financing to cover new equipment.

In other words, although it may not seem advisable to charge off the entire cost of new equipment as an expense during the year in which it is bought, and although this cost properly should be distributed over a considerable period of years, nevertheless, depreciation must be figured as actual and not theoretical and a reserve fund should be set up to allow for replacements when and as needed. In the long run an attitude such as the one outlined above would benefit the purchaser, as well as the entire machine tool industry.

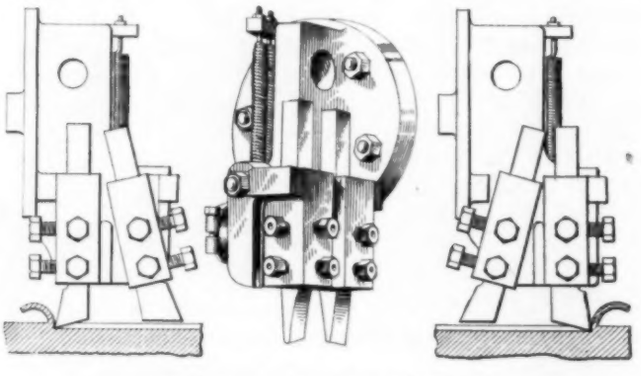
Savings in the Cost of Planer Work—Discussion

By F. L. Watson
Managing Director, Joshua Buckton & Co., Ltd., Leeds, England

On page 523, Vol. 62, of the *American Machinist* there appeared an article by Tell Berna, under the title given above. I beg leave to take issue with some of Mr. Berna's statements in regard to double-cutting tools.

We introduced at least 40 years ago, a double-cutting toolholder, as shown in the illustration. We have this type of toolholder still in regular use and it will be observed that it possesses none of the quaint features of the apparatus which Mr. Berna put forward as a typical double-cutting toolbox. With our planing machines, there is no necessity to arrange for overtravel at the ends of the stroke, since the feed gear operates actually at the moment of reversal and requires no extra provision for overtravel.

We regularly use our double-cutting toolholder on all straightforward bed and table planing, and we switch over our planing machines to quick return whenever we do not wish to use the double-cutting toolbox. To take



An English double-cutting tool

full advantage of this method, it is, of course, obvious that reversing-motor drive is required, in which the electric control can be instantly set for either quick return or cutting both ways.

It will be seen that the double-cutting toolholder does not introduce any element of weakness into the saddle. Mr. Berna says "The tools must be set to the same height and that takes a few minutes every time we start with new tools." If he will modify this statement so as to make the time a few seconds instead of a few minutes, we will be in agreement on that score.

Tables Made in Two Parts

The article further on mentions what is described as a novel method of reducing the setting up time, consisting of making the table in two parts, one of which can be loaded while the other is in use. This is a very useful arrangement but is by no means novel. Many machines so arranged are in use in this country and we have frequently made them ourselves.

The scheme of having an automatic record of the work of planing machines is a good one, and might effect quite a large saving in shops that are willing to pay the cost of installing the apparatus, and what is more important, keeping it in constant operation and making regular use of the records.

Attitude of Employers Toward Labor

By Walter J. Matherly

THE attitudes of employers toward labor are many. There are employers who are actuated by expediency. There are employers who believe in fighting and there are employers who believe in repression. There are employers who cannot see anything except the immediate pecuniary gain and there are employers who take the long-run point of view and place labor administration upon a high managerial plane. Regardless of these varying attitudes of employers toward labor, the future will undoubtedly see a decrease in the other attitudes and an increase in the scientific attitude

IN A general way there are almost as many types of employers as there are types of individual men. What the attitude of each toward labor is in every case is difficult to determine. Some employers assume a paternalistic attitude, while others assume a fighting attitude. Some are conciliatory as to labor policy and are animated purely by motives of expediency, while others evaluate personnel activity in terms of an immediate cash return. Finally, some are genuinely interested in modern scientific methods of labor management, while others are affected by influences reaching far back into the history of the past.

The original attitude of employers toward labor was perhaps that of master and servant. It may still be the attitude in some cases. Such an attitude is easily explained by a brief reference to history.

Prior to the nineteenth century agriculture was the principal industry. The masses of the people were poor, the standard of living low and earnings were meager. At the beginning, factories were small because of the scarcity of capital, and the supply of labor was almost inexhaustible. Since the demand for labor was greatly disproportionate to supply, there was great competition among working people for jobs offered by the rising factory system. When the employer offered work to the struggling masses, it was looked upon as a favor, granted by the master to his servant. This idea was strengthened by the earlier period of serfdom which had left a natural tendency to servitude in the minds of the workers. Consequently, the concept of employers became the master-servant concept. This concept still survives today in the realm of law.

The attitude of master and servant characterized employers to a large extent during most of the nineteenth century. Abuses in the early factory system were abundant. Hours were long. Workplaces were filthy, unlighted and unsanitary. Welfare work was carried on only by such isolated employers as Owen in England, Leclaire in France and later some employers in America. The military form of control became the prevailing type of industrial organization. The slave-driver system of management was introduced. The managers motivated the workers by fear, by compulsion and by threat of summary discharge. The commodity conception of labor was born. In fact, until almost the close of the first decade of the twentieth century, the employer was prone to think of himself not only as the owner of the jobs which he had to offer but also as owner of the workers themselves.

Since 1910 industry has witnessed a decided change. While it is undoubtedly true that the notion of master and servant still survives in some quarters, it is gradually disappearing. But that does not mean that all employers or even a majority, are assuming an enlightened attitude. As a matter of fact quite the reverse is probably the case. There is still a variety of attitudes. What are these attitudes? It may be worth while to attempt to answer that question by studying what appears to be some typical attitudes of employers.

To begin with, consider the paternalistic attitude. Paternalism in the past and to some extent in the present has characterized a great many employers. Labor policies, whether coming under the head of welfare work or otherwise, have been conceived in a spirit of benevolence. The attitude toward labor has been an attitude of a father toward his children. Although almost every employer has found that welfare or other work has paid, the motive which has prompted it has not been primarily economic but philanthropic. What was done in all too many instances bore the impress of charity. All too frequently the labor problem has been attacked with a paternal sense of justice, with a benevolent ideal of industrial equity and as a result the "dividends of profit have reached the workmen in the form of discriminating charity."

Organized labor has always opposed paternalism and welfare work as ordinarily practiced. And why? As Daniel Bloomfield has pointed out, "it is not that the worker is unappreciative, but that he will not be patronized. He objects to having his initiative weakened or destroyed. Furthermore, he has had bitter experience with employers who have used welfare work as a club over him, who have conducted it for advertising purposes, or who have used it as a substitute for a fair, living wage."

The workers' objections to paternalism are many. It makes employees feel that grants are obtainable only under pressure. It looks like the acknowledgment of obligations that are only partly met. It makes the laborers feel that they are the recipients of charity. Its benefits represent arbitrary additions to real wages, since labor has no voice in determining what activities the employer shall or shall not engage in, and since what is received is an excess over money wages. Its value has been so overstressed and overadvertised that workmen have become disgusted; and, rather than diminishing, it has tended to increase labor discontent. In many instances employers have bragged about their sick benefits, their model towns, their playgrounds, and their welfare policies to such an extent that employees

have suspected that all such activities were mere excuses for further exactions, mere smoke screens to hide bad conditions, mere substitutes for justice.

The paternalistic attitude always leads to failure. The best intentioned plans for paternally assisting the workers have not met with the success that was anticipated. Illustrations of the truth of this statement are abundant. All we need to do is to recall the experience of employers at Pullman, Ill. Other examples are numerous. In spite of the millions that have been turned into welfare work by paternalistic employers throughout the United States, costly strikes have continued to occur and labor unrest has continued, not only to exist, but in some quarters actually to increase.

While some employers have assumed the paternalistic attitude toward labor, there are other employers who have assumed the fighting attitude. Those who take the fighting attitude insist on the right to manage their own businesses as they see fit. They believe in *laissez faire*. They demand that meddlers of every sect be shut out. They fight everything that interferes with their freedom.

Fighting Employer on the Decline

The attitude of the fighting employer is a product of the past. "His viewpoint," to quote somewhat at length from Atkins and Lasswell's Labor Attitudes and Problems, "dates from the days of the commercial revolution, which broke down the collective management of industry in the medieval guild, and produced the independent enterpriser who took upon himself the unaided direction of industrial policies by virtue of his ownership of the productive apparatus. This new figure in society had to fight his way against the restrictions of ancient customs which were sometimes entrenched in the laws. From the battle with guild restrictions in Italian towns and the vigorous struggle with poor laws in England, the leaders of modern industry emerged with a clear-cut philosophy: 'Let every man run his own business. Keep out the meddlers.'

"For some time workers were not in a position to launch a counter offensive against such ideas, but in England they gained sufficient power to challenge the employers soon after the culmination of the battle against ancient regulations. The employers had their philosophy ready-made to meet this onslaught. In their eyes it stood for the re-imposition of intolerable restrictions, and they turned against labor the weapons of theory and practice which they had successfully forged in the earlier conflict.

"Moreover, the tradition of absolute independence on the part of the employers was fortified by its success in the days when competition among producers began to reach a more nearly stable relation with the market. Rapidly expanding markets meant that cost margins were relatively wide. The demand was for goods, more goods. Savings possible through better internal administration were ignored in the scramble for increased output."

In recent years the fighting employer has changed his attitude to some extent. The labor-be-damned policy is fast disappearing even among the alleged "hardboiled" employers. At least there are certainly not so many fighters as there once were. It has begun to dawn on some of them that perhaps it is wiser to fight less and cooperate more, to unite in their efforts with labor rather than to arouse dissention. War is always destructive and the trail of bitterness which it leaves behind usually retards rather than increases productive efficiency. Indeed, it is perhaps not too much to say that, with every fresh onslaught of enlightened ideas concerning labor relationships, the fighting attitude is gradually being relegated to the past.

Closely related to the fighting attitude, and even in many cases part and parcel of it, is the conception of repression. Some employers take the point of view that the way to get rid of labor difficulties is to repress them. When industrial unrest raises its ugly head they argue that the best thing to do is to stamp it out immediately by ruthless methods.

Immediately after the World War, when every man with even a modicum of conservatism, was seeing "red," this attitude was much in evidence. Many employers, politicians and others, were arguing alike that strict legislation should be enacted prohibiting seditious speeches, threats of strikes and attempts to stir up labor unrest. They prodded the department of justice into investigating revolutionary organizations and into prosecuting radical labor leaders. They advocated the deportation of all aliens who did not show the warmest sympathy for the United States. Some men even went so far as to take the position that all disturbers of national peace, labor or otherwise, should be shot on sight. The attitude of repression so prevalent at that time is undoubtedly still the attitude of some employers today.

But there is one thing which every man, whether employer or not, must remember. Repression is not a plaything; it is an instrument of danger. While repressive legal and other measures may produce immediate practical results and put a stop to labor demands at least temporarily, repression is loaded with dynamite. As has been frequently pointed out, it is impossible to bottle up steam without incurring the danger of explosion. Consequently, it is better perhaps to have a safety valve for the escape of pent-up protests against wrongs, actual or imaginary, in the industrial system than to resort to ruthless methods and a strict policy of suppression.

Conciliatory Attitude Because of Expediency

Wholly different from either the fighting attitude or the repressive attitude of employers toward labor is the conciliatory attitude. The employers who assume a conciliatory point of view do so for the sake of expediency. When the union is strong and strikes are likely to be costly, they find it expedient to practice the closed shop. When the labor supply is scarce and the workers demand collective bargaining, they may become collective bargainers. If new methods are suggested and they have a reasonable assurance that output thereby will be increased, they readily become the exponents of advanced ideas. But let the circumstances be reversed, and they do not hesitate to reject the closed shop, oppose collective bargaining and cast slurs upon proposed new methods of labor management. In other words, their fundamental policy is a policy of opportunism.

That a number of employers are actuated by motives of expediency is not very difficult to explain. They are afraid to commit themselves on mooted questions. While union recognition or employee participation in management may be desirable in some cases, in others they hamper freedom of action and may lead to the restriction of credit. Investors do not always take kindly to innovations. So-called advanced methods of handling labor have not always led to increased profits.

Consequently, employers who hesitate to fall in at once with new ideas, or who are charged with flopping from one side of the fence to the other, as circumstances demand, may not necessarily be guilty of managerial depravity. After all, they may be exhibiting a deeper knowledge of competitive forces and following a wiser policy of management than their traducers sometimes realize.

Another attitude of employers toward labor is that of an immediate cash return. Those who take this point of view shrewdly evaluate all personnel work in terms of quick financial profit. If any mechanism of labor management will effect an immediate saving or bring about an additional dollar of profit, employers of this type are ready to seize upon it. Otherwise they are not interested.

Of course it must be admitted that all phases of management depend upon profit for their success. The test of every activity is the test of pecuniary gain. Sound economic policy requires that every employer reduce every item of his business to the basis of profit. No industrial enterprise can long continue unless a return is secured upon invested capital. Profit margins are the foundation stones of the entire industrial system.

Since this is the case, it is not surprising that a large number of employers view personnel management in the light of pecuniary results. This is the only sane thing they can do. But when they look for profit immediately visible, rather than profit over a rather long period of time, they are on the wrong trail. The employer who takes this position is taking a position which is untenable. The introduction of scientific methods in handling personnel may not lead to an immediate cash return. In fact, before such methods show results in the income statement, a prolonged period may elapse. Anyone taking a single year or even two years as a criterion for judging the value of personnel work may find little in it of financial worth. It is only after some time that results will begin to appear. The real test is whether or not scientific labor policies exhibit a profit over a period of years.

The Scientific Attitude

Finally, there is an increasing number of employers who are taking the scientific attitude. Since the beginning of the second decade of the twentieth century employers have been actuated more and more by scientific motives. In approaching labor management, they have taken the point of view of the careful investigator, of the expert, of the devotee to science, subjecting all personnel activities to scientific analysis and reducing the field of personnel administration to a classified body of scientific knowledge. Here as elsewhere in industry, many employers are struggling to replace the age of guesswork and rule of thumb with the age of science and reason.

Among the employers with the scientific attitude, the idea of paternalism, with its implications of discriminating charity, has no part or place. Patronizing of employees in every form is discarded as unworthy of enlightened management. To them the task of administering labor is a specialized function, important enough to be split off from the chief executive's task and placed in the hands of a functional expert called the personnel manager. In other words, they recognize the need in industry of a new functionary with power to devote the same attention to human as to non-human factors in industrial organization.

It is with employers of this type that the greatest advances have been made in personnel work. They have taken the lead, engaged in the experimental effort necessary to proceed with scientific precision. They and they alone among the employing class have been the torch bearers of a new day in industrial relations. Recognizing that management is a specialized, professional function, separate and distinct from the function of finance and investment, they have increasingly sought to perfect management technique and place the handling of the human element in industry upon a high managerial plane.

The attitudes of employers toward labor, then, are many. There are employers who are actuated by paternalism and there are employers who are actuated by expediency. There are employers who believe in fighting and there are employers who believe in repression. There are employers who cannot see anything except the immediate pecuniary gain and there are employers who take the long-run point of view and place labor administration upon a high managerial plane. Regardless of these varying attitudes of employers toward labor, the future will undoubtedly see a decrease in the other attitudes and an increase in the scientific attitude.

Theory and Practice

By Frank Waldo

In mechanical work the theoretical man is often criticized because he is inclined to make errors due to a lack of shop training. The criticism is sometimes just, yet frequently the theorist's idea may be practically correct, and fails only because the shopman does not co-operate. The shopman is frankly skeptical of the technical man's ability in actual machine work, but when a special thread is to be cut on a lathe or a piece of work is to be milled in such a way that it requires differential indexing, he goes to the technical man for help in making the calculations necessary to determine the gears for the work.

The shopman from long practice has become familiar with processes of machining and knows how to produce his work rapidly and with accuracy, yet if he were asked why he sets his tool in a certain way or grinds it to a given shape he might not be able to tell the exact reason. He knows that it will work better that way and so he does it. His past experience with similar work shows him how to go about a certain job. It may seem unnecessary for the operator to understand all of the reasons why certain operations are performed in a given way, yet it is clear that the high-grade man should know the theoretical reasons as well as the actual shop practice.

The shopman's ideas are undoubtedly valuable as his knowledge is gained by long experience, but on the other hand the technical man has obtained his information from careful study and an application of principles and theory. Both men deserve credit and by a spirit of co-operation each can learn from the other many things that will be mutually profitable.

In order to be thoroughly efficient, a man should have a judicious combination of both theory and practice, his theory being well backed up by actual practice in manufacturing work. In other words the shopman needs more theory and the theoretical man needs more shop practice.

Book Reviews

Drafting Methods. By Douglas S. Trowbridge, Assistant Professor of Civil Engineering, New York University. Clothboard covers, 166 pages, 5½x8 in., illustrated. Published by the Codex Book Co., Inc., New York, N. Y. Price $2.50.

The book presents information that is of value alike to designers and draftsmen. The first chapter is devoted to a description of the many instruments available on the market. The second chapter is taken to explain their use, and brings out many points, not generally known, that can be used to advantage.

There is a chapter on lettering, another on accepted symbols and abbreviations, and another on filing methods for the drafting room. Two chapters are given over to drafting-room kinks, one as pertains to the instruments and one on the work. A final chapter contains many useful "Nevers and Don'ts."

The author has successfully placed before the draftsman a fund of information he does not generally have, that he may have opportunity to do his work to better advantage and with less of effort.

The book can be used by the designer or draftsman to bring his tools up to date and to make efficient use of them to his own and his employer's advantage. The symbols and abbreviations, which are given for all fields of engineering, can be put to work in many directions.

The lists of kinks, incidentally, illustrate the efficiency of the author's methods of clipping and filing ideas from practical men that have been published over a period of time largely in the *American Machinist*. The explained filing methods, as well as the kinks themselves, constitute a wealth of useful information.

The book is clearly enough presented to be a valuable text for the beginner, a guide for the draftsman and a reference for the designer in the field of drafting.

Labor Relations in Industry. By Dwight Hoopingarner, Executive Counsel on Industrial and Commercial Relations; Executive of the American Construction Council; Director of the New York Building Congress; formerly Lecturer in the Graduate School of Business Administration, Harvard University. Five hundred forty-two pages, 6x9 in. Flexible leather binding. Published by the A. W. Shaw Co., Cass, Huron and Erie Sts., Chicago, Ill. Price $6.

Mr. Hoopingarner's book is carefully and conscientiously prepared. It deals with a subject of great magnitude and is necessarily long. There is no matter not pertinent and there are no unduly involved discussions. To one genuinely interested in labor relations in industry it will be a pleasure to read the book aside from the informative results.

It is inevitable and desirable that a book dealing with human relations in industry should contain something of the personal opinion of the author. This one does. Yet no effort has been spared to set forth the opinions of others. There are thirty-five pages of bibliography and innumerable "selective references."

According to Mr. Hoopingarner's statement, "The subject is approached primarily from the standpoint of industry as a whole, of the state, and the relations of industry and the state to each other, rather than of individual plant organization. In discussing the part played by industry as such, however, the broad aspects of plant policy and organization that have been developed for administering the principles set forth are included, together with the important considerations of the individual worker as he is affected by the whole relationship.

"Accordingly, the specific purposes of the book are, first, to give a basis for developing a general point of view on labor relations; second, to make an analysis of the major problems involved; third, to indicate the major trend of development of policy and organization in the respective fields; and fourth, to offer, in each case, constructive suggestions of a fundamental nature for the handling of administrative problems arising out of these relations."

And again, "The most practical thing that industry needs today is an industrial philosophy that is human, and, being human, is most efficient."

There are twenty-eight chapters, the bibliography and an index. The twenty-eight chapters are divided into eight parts: A Point of View in Labor Relations; the Control of Labor Relations; the Division of Earnings; Working Periods and Labor Supply; Health Conservation; Special Social Considerations; Focal Plant Relations; World Scope and Trends.

Condensed Catalog of Mechanical Equipment. Fifteenth edition, 1925-26. Eight hundred twenty-six pages, 9 x 12 in. Published by the American Society of Mechanical Engineers, New York. Price $5.

The fifteenth edition is well printed on thin paper and has flexible covers, as usual. It is convenient to handle considering its size and the number of pages. There are 479 firms advertised in the 585 catalog pages and 4,400 firms listed in the Mechanical Equipment Directory, while the classifications of equipment number 5,000. In addition there are 575 engineers listed in the section devoted to Professional Engineering service.

The catalog section contains a wide variety of engineering products in which power and transmission machinery and appliances play a large part, this including boilers, ball and roller bearings, conveyors and transmission machinery, meters, tanks etc. A note says that "all data presented have been edited with a view to the elimination of advertising claims or exaggerated statements and every effort made to restrict the catalog to forms of good standing."

There are over 2,600 illustrations and the equipment directory contains over 39,000 separate listings.

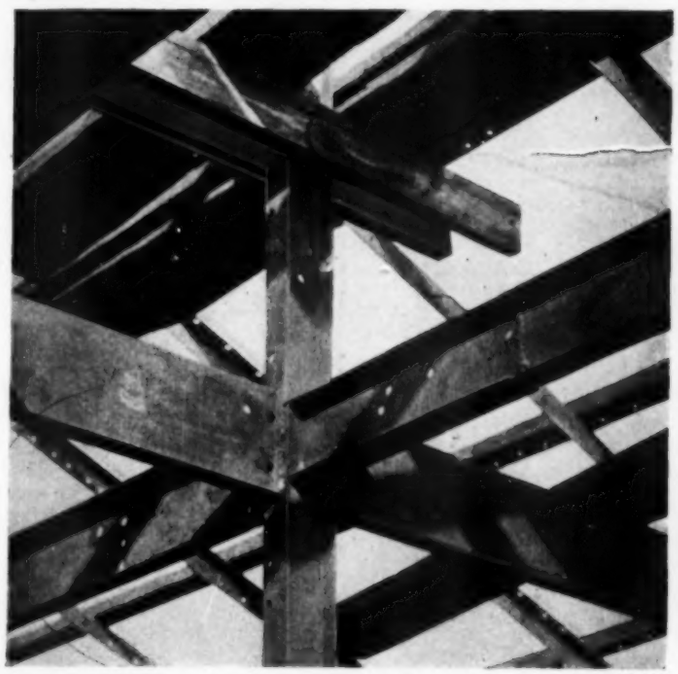
Comparative Slow-Bend and Impact Notched-Bar Tests on Some Metals. By S. N. Petrenko. Technological paper No. 289. Pages 315 to 346 of Vol. 19. 7x10 in. Published by the Bureau of Standards, Washington, D. C. Price 20c. In this paper, the author reports the results of his experiments as to whether the slow-bend test may be used instead of or supplemental to the impact test. The slow-bend test gave values lower than the impact test for non-ferrous materials and higher for steels. A report is also made on the relationship of the two tests in respect to various sizes and shapes of notches.

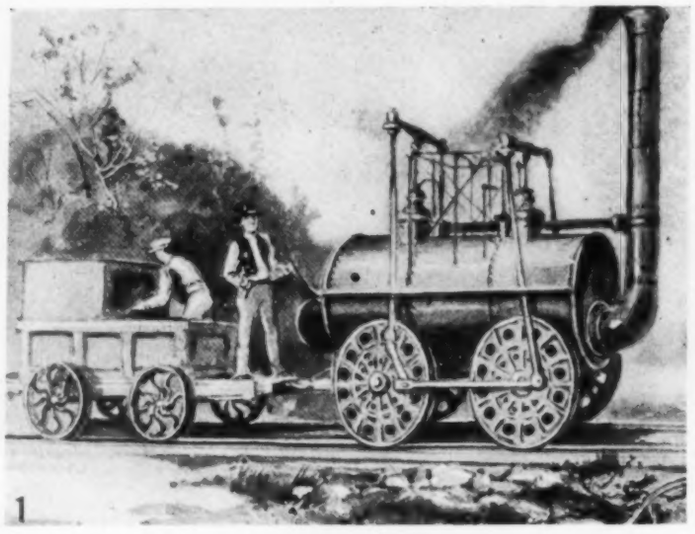
A Welded Shop

The illustration above shows the structural skeleton of the 60x40-ft. shop put up by the Eola Electric Arc Welding Co., Eola, Ill., early this year. At the right is a close-up of some of the larger arc welds and below can be seen some of the welds where the purlins join the rafters.

An exactly similar building was constructed in the customary way with rivets instead of welds. It is interesting to note that the shop fabrication alone of the second building cost 95 per cent of the whole cost of the first one while the total cost was 70 per cent greater.

Photographs by courtesy of the Westinghouse Electric & Manufacturing Co.





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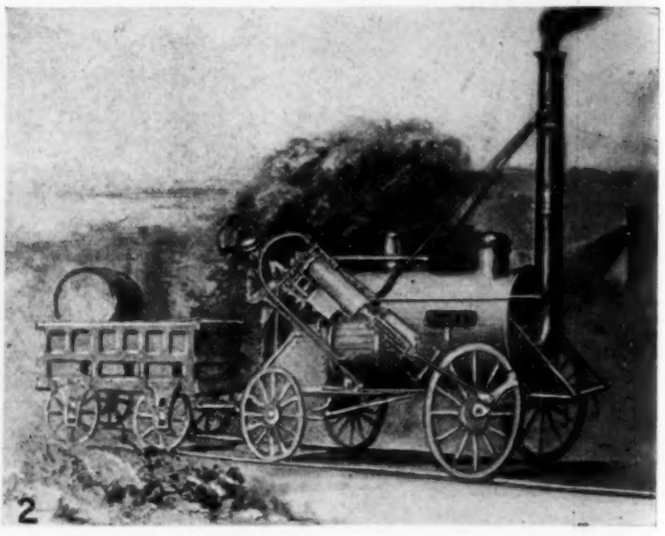

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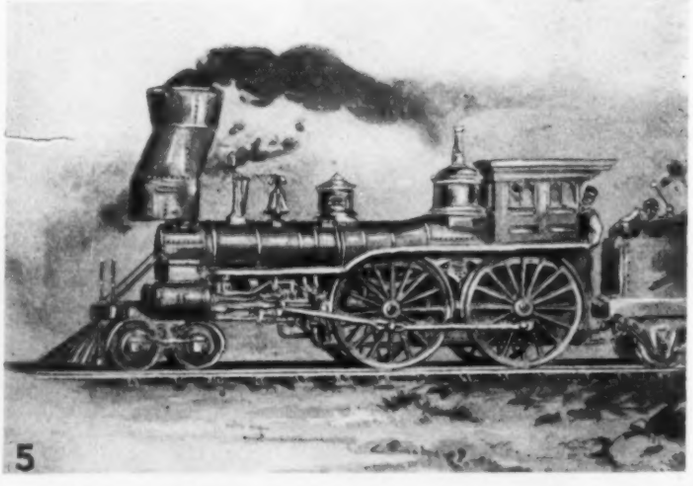
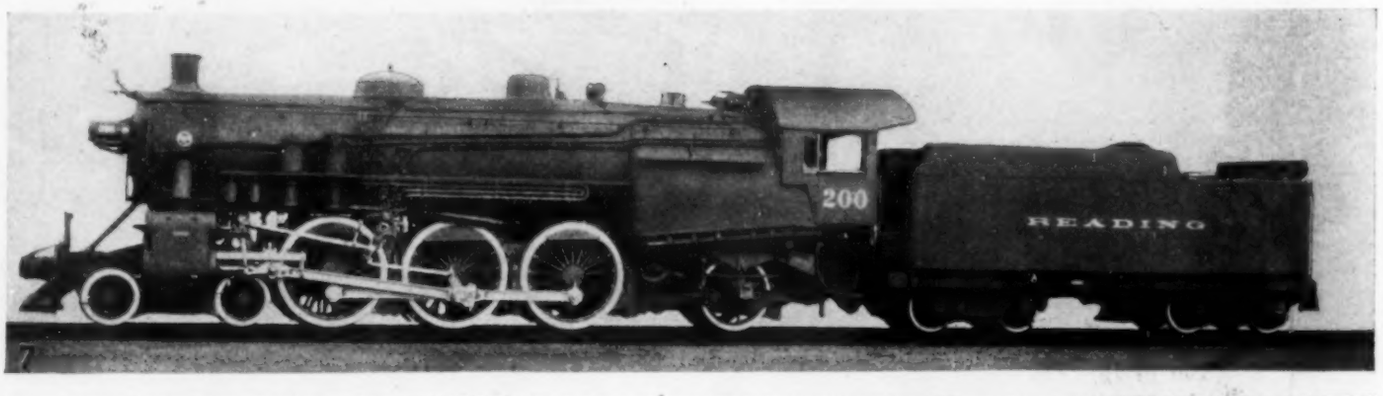


5

A Hundred Years

1. *1825—Stephenson's first locomotive*
2. *1829—Another early locomotive by Stephenson*
3. *1832—First Baldwin locomotive*
4. *1848—A well-known Rogers locomotive*
5. *1855—McQueen's 8 wheeler*



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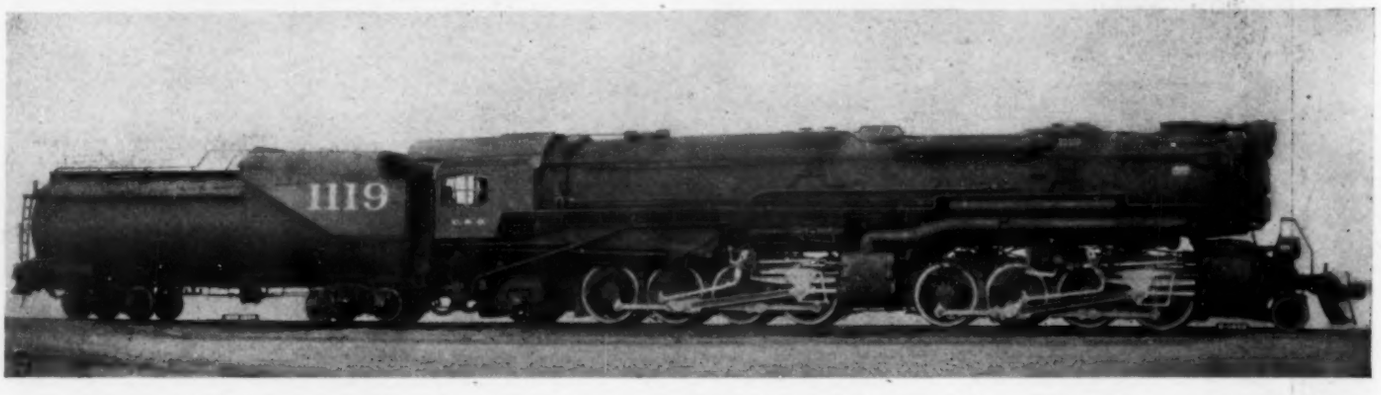
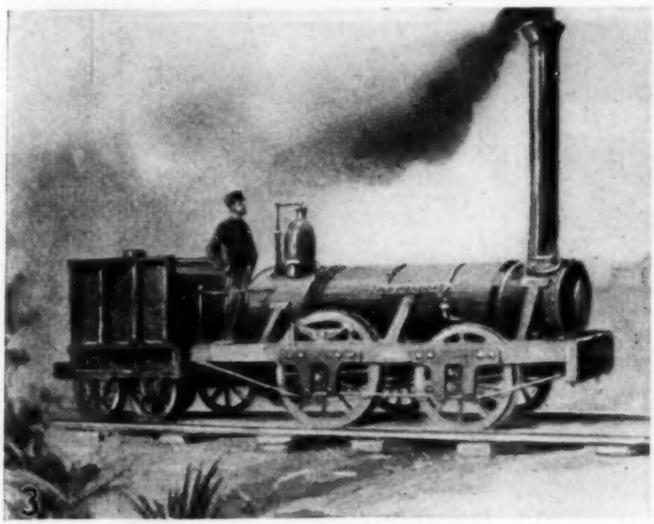
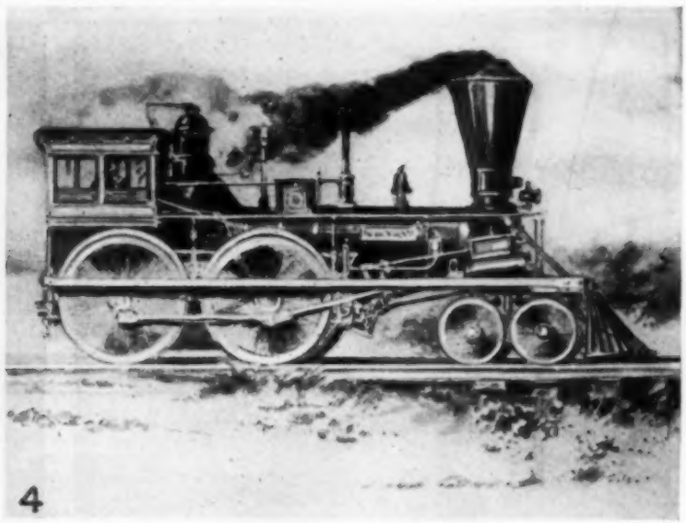






# of Railroad Progress

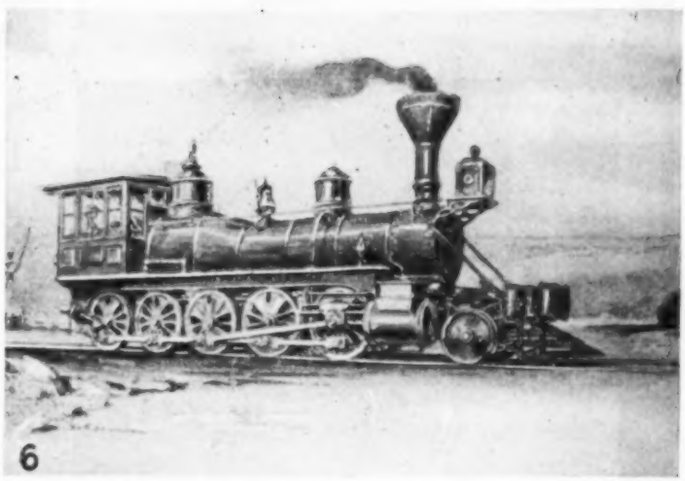
6. 1867—First locomotive of decapod type

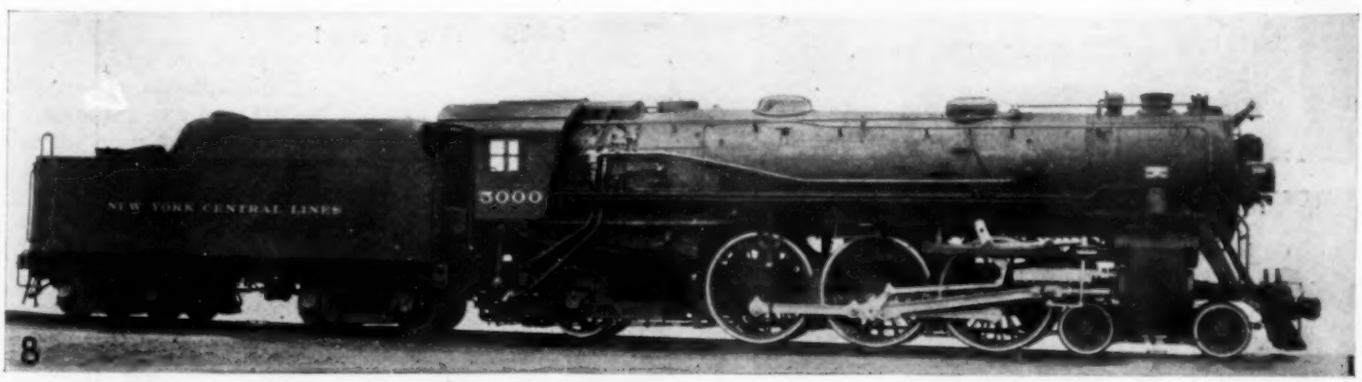
7. 1925—Baldwin pacific type

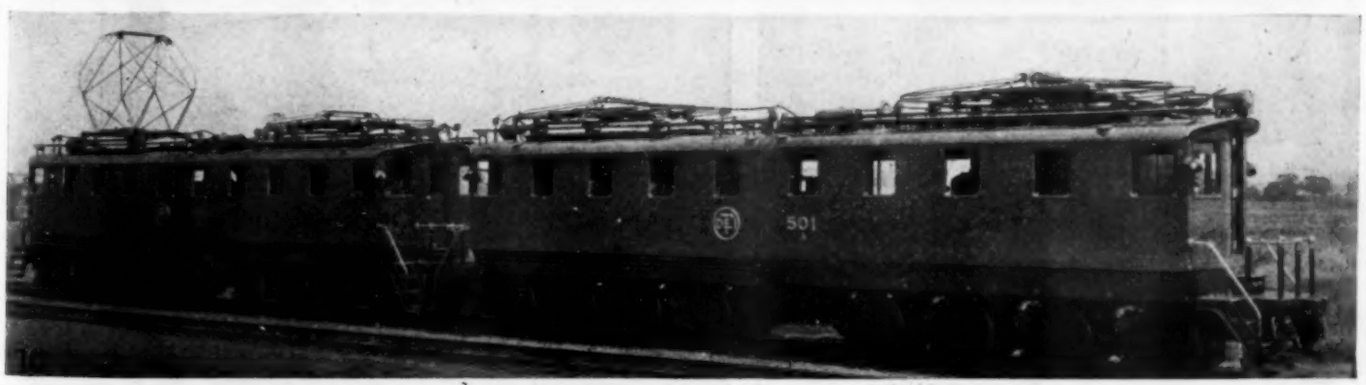
8. 1925—American pacific type

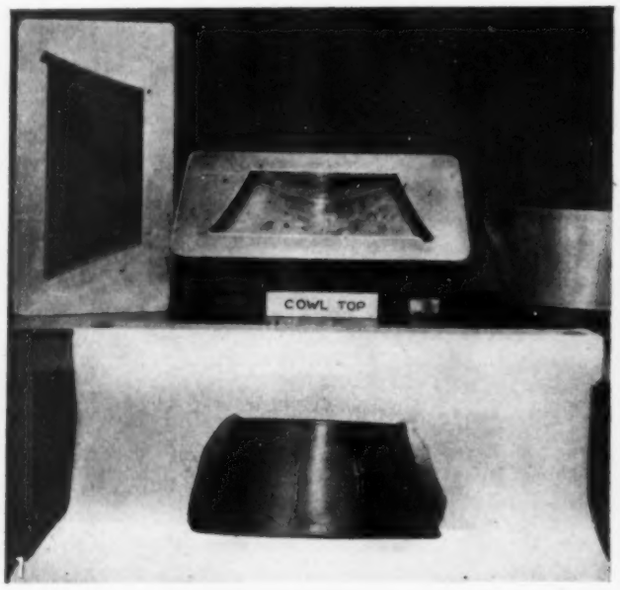
9. 1925—American mallet type

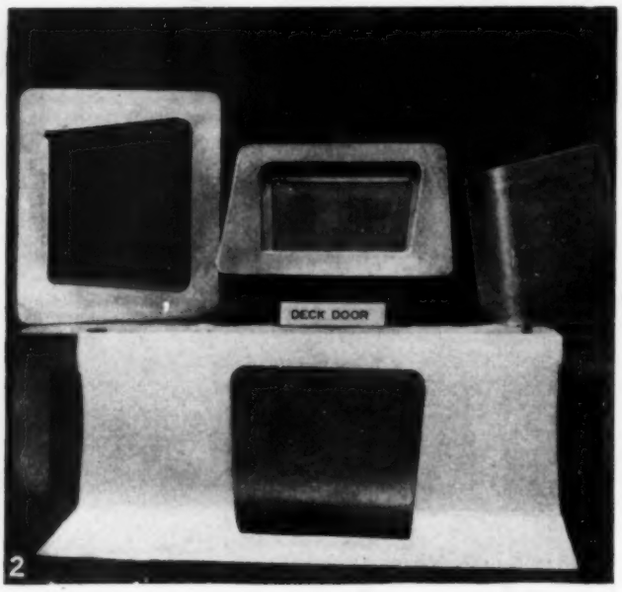
10. 1925—Electric locomotive on Ford's railway

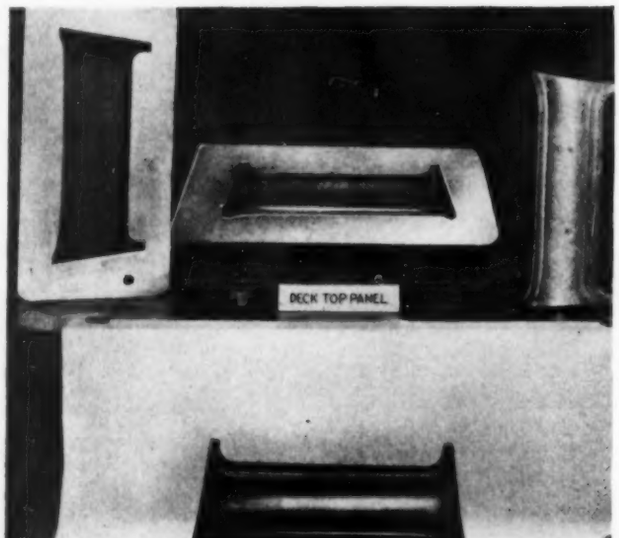












Dies and Parts for Wolseley Automobile Bodies

1—Top of cowl

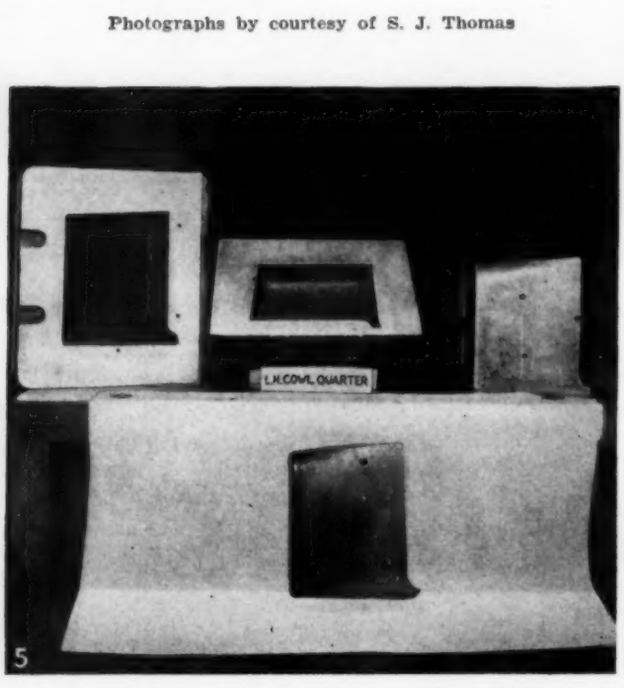
2—Deck door

3—Deck top panel

4—Right side of cowl

5—Left side of cowl

Photographs by courtesy of S. J. Thomas



Ideas from Practical Men

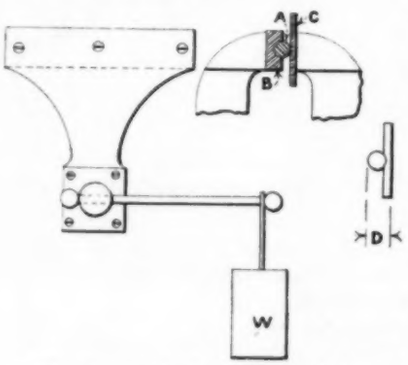
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Testing Hardness of Metals

By Charles Kugler

The illustration shows a cheap way of testing the comparative hardness of metals, in a similar manner to the method employed in the Brinell system.

The steel ball *A* is imbedded for half its diameter in the piece *B*, and held in an ordinary vise, together with the piece *C* to be tested. The vise jaws are closed just enough to hold the parts in place, when the weight *W* is hung on the lever as shown.



Simple method of determining comparative hardness

A sample piece, known to be of the correct hardness is first tested and the depth of the indentation made by the ball, measured. Other pieces tested should show the same amount of indentation, to be acceptable.

Knowing the diameter of the ball and the thickness of the piece tested, the depth of the indentation can be measured as at *D*.

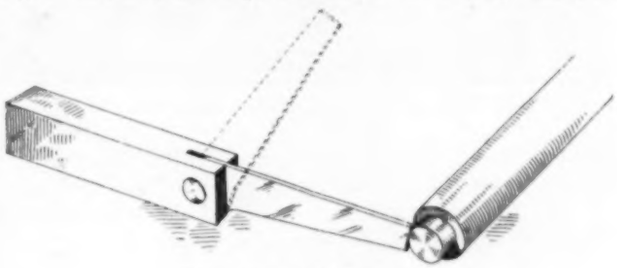
For a shop that cannot afford an expensive testing instrument, or a shop that has not enough testing to do to warrant the purchase of one, this method will be found to be an efficient substitute.

Tell-Tale Gage for Setting Tapers

By H. L. Wheeler

When it comes to setting a taper attachment or the tailstock, as the case may be, for turning a taper, the simple tool shown in the illustration is reliable and accurate, and should be in every lathe-hand's kit. It is made by cutting a slot $\frac{1}{4}$ in. wide in the end of a piece of machine or cold-rolled steel, $\frac{3}{4}$ by 1 in. and about 4 in. long. The finger is made from a piece of sheet steel $\frac{1}{4}$ in. thick and is held in place with a rivet.

For cutting special tapers, the procedure consists in turning two diameters on the shaft corresponding to the large and small diameters of the taper. These diameters may be cut by running a parting tool into the work and calipering until they are correct. The tell-tale should be placed in the toolpost, and adjusting the cross-slide until the finger just touches the small diameter of the work. Then, without moving the cross-slide, run the carriage to a position where the finger will be opposite the large diameter. Now note the relation between end of finger and the work. If it touches too hard, the tail center must be set over or the taper attachment adjusted until it nearly touches.



Gage for setting tapers

Traverse the carriage back and forth between the two points, adjusting the tail center or taper attachment, and trying each diameter until the finger lightly touches the shaft at each diameter.

Start from the same end at all times, so that the backlash in the cross-feed screw will take up before the gage touches the work; that is, run the carriage in the same direction the feed will run it when cutting.

Drill-Press Belts Well Guarded

By Jack Williams

There are many belt-driven drill presses that have a short countershaft at the rear of the column near the floor, this shaft carrying the tight and loose pulleys for starting and stopping the machine as well as the first one of the cone pulleys for changing the speed.

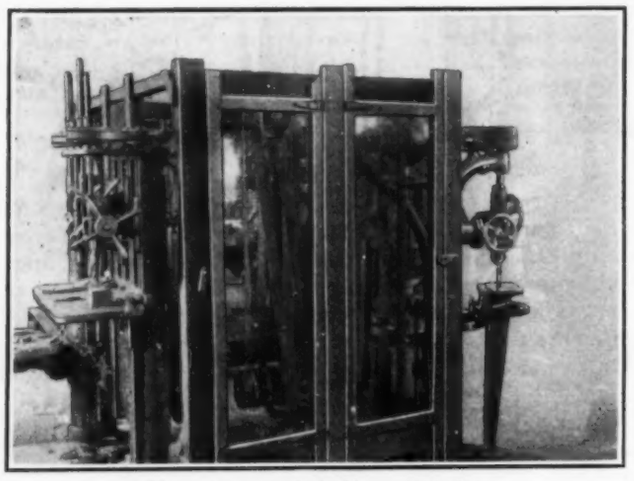
Because of their exposed location and the fact that they come down close to the floor, where they are extremely likely to catch any loose garment worn by a careless operator or unwary floorman, such belts were among the first things to occupy the attention of safety committees.

It was not a difficult problem to guard them, but in his zeal to render them harmless, it was easy for a safety-first enthusiast to box up the belts so tightly that an operator would find it practically impossible to reach the cone belt when changing speeds.

One method of guarding the belts, without putting them out of easy reach of the operator, is shown in the accompanying illustration, where two pairs of drill

IDEAS FROM PRACTICAL MEN

presses are grouped back to back and partly enclosed by a framework covered by wire netting. A door in one end of the cage thus formed, allows the floorman to get in to do necessary cleaning and oiling. The wire net is so arranged on the sides of the cage occupied by



Cage to guard drill-press belts

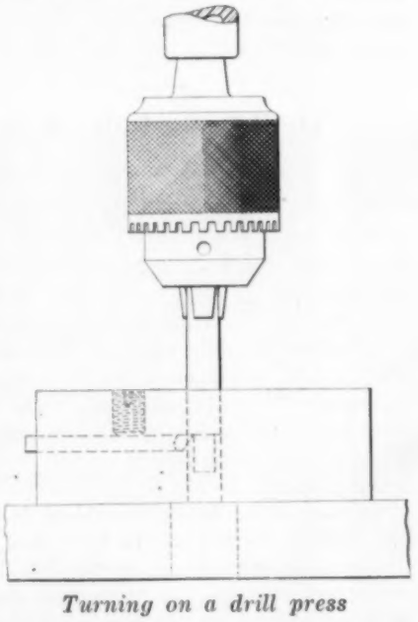
the machines, that an operator can shift his cone belts from the front without going into the cage.

This scheme was found in practice at the shops of the E. R. Patch Co., Rutland, Vermont.

Lathe Work in a Drill Press

By Charles Kugler

Having a lot of ½-in. round pins to be shouldered on the end, I arranged to do the work in a drill press by drilling and reaming a hole of suitable size through a block of machine steel, drilling a crosshole to intersect it and setting into the latter a round cutter made from drill-rod. A headless setscrew served to locate and hold the cutting tool. The set-up is shown in the sketch. While this method is not recommended as a substitute for a lathe it may be found useful by others when there are a lot of such pins to be turned and no lathe available. It has the advantage that the work can be done by unskilled help, and there is little chance to go wrong.



Turning on a drill press

Checking Gears by the Wire Method

By H. G. Thuesen

When cutting gears having teeth too small to be measured with a gear-tooth vernier it is difficult to ascertain if the teeth are cut to the proper depth.

Assuming that the gear has been cut by a correct hob or cutter, the depth of the teeth will be correct if the pitch diameter is correct. This fact is the basis of the following formula for determining the correctness of the pitch diameter of a gear by means of wires.

In Figs. 1 and 2 the wires are shown in place, tangent to the tooth curves at the pitch circle. This

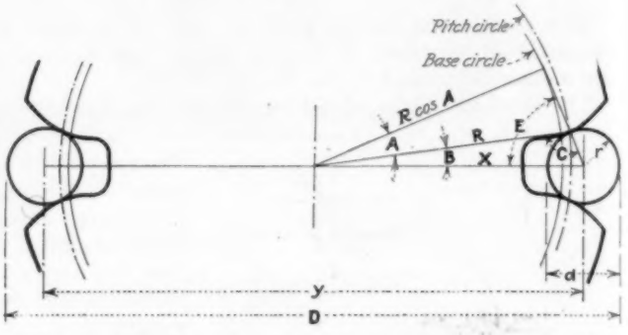


Fig. 1—Checking a gear with even number of teeth

places the centers of the wires on a line drawn tangent to the base circle and through the intersection of the tooth curve and the pitch circle.

To determine the distance D,

Let R = correct pitch radius;

A = pressure angle;

N = number of teeth.

For an even number of teeth, Fig. 1 will be an example.

$$\text{Then angle } B = \frac{360 \text{ deg.}}{4N}$$

$$\text{angle } C = 90 \text{ deg.} + A$$

$$\text{angle } E = 180 \text{ deg.} - (C + B) = 90 \text{ deg.} - (A + B)$$

In triangle C, let k be the altitude upon X,

$$\text{and since } \frac{r}{R} = \frac{\frac{1}{R}}{\frac{1}{r}}$$

$$\frac{r}{R} = \frac{\frac{k}{R}}{\frac{k}{r}} = \frac{\sin B}{\sin E} \qquad (1)$$

$$r = \frac{R \sin B}{\sin E}$$

$$d = 2r = \frac{2R \sin B}{\sin E}$$

By the same method as for equation (1), it will be found that

$$\frac{X}{R} = \frac{\sin C}{\sin E} \qquad (2)$$

$$y = 2X = \frac{2R \sin C}{\sin E}$$

$$D = y + d$$

The values of y and d may be calculated from the

IDEAS FROM PRACTICAL MEN

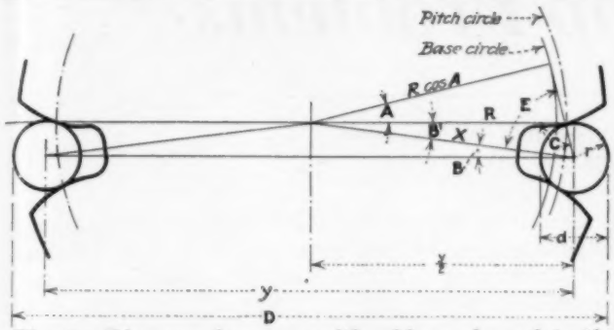


Fig. 2—Diagram for gear with odd number of teeth

values of the angles above given, and if D, in actual measurement, is greater than it should be according to the calculation, the teeth must be cut deeper.

An odd number of teeth is shown in Fig. 2.

Angle B = angle B' (included angles of parallel lines)

$$\cos B = \frac{\frac{y}{2}}{X} \qquad (3)$$

$$\frac{y}{2} = X \cos B$$

$$y = 2X \cos B$$

$$D = y + d$$

Wires of the size required may be easily made by reducing a piece of drill rod of the next larger size by polishing it in a bench lathe. The size of the wire required is, of course, shown by the value of r in equation (1) given above.

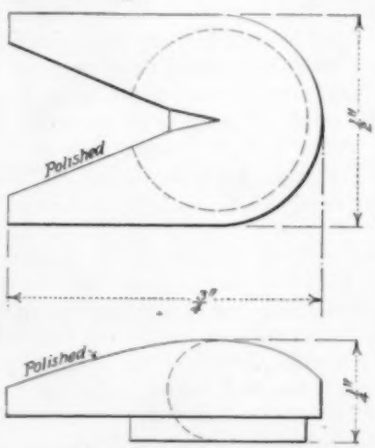
Improvised Polishing Wheels

By Wm. R. Scott

Recently, I had to polish 100 hardened-steel pieces, like the one shown in the sketch.

Since I had no regular polishing wheel, I bored a $\frac{3}{8}$-in. hole in a block of wood $1\frac{1}{8}$ in. thick, mounted it on the spindle of a tool grinder, and turned it to $3\frac{1}{4}$ in. in diameter, I then sawed a radial slot in the block. A strip of abrasive cloth, longer than the circumference, was wrapped around the block, the ends turned into the groove and fastened with a wedge.

For polishing the V-groove, I cut a disk of tin $3\frac{1}{8}$ in. in diameter and two disks of abrasive cloth $\frac{1}{8}$ in. larger, and cut holes in them of a size to fit the spindle of the tool grinder. With the tin between the disks of abrasive cloth, this polishing disk was mounted on the tool grinder, using washers on both sides. With the improvised wheel and disk the polishing was done in a first-class manner.



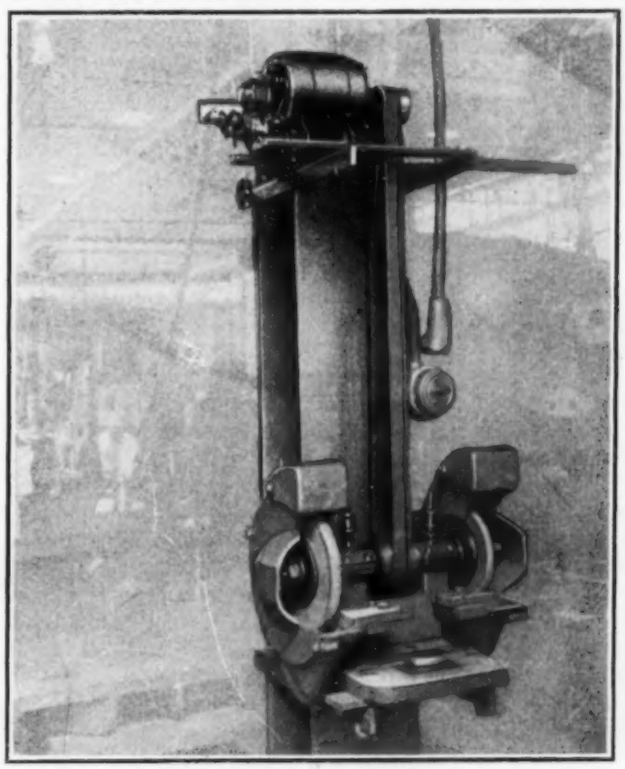
The piece to be polished

Tool-Grinding Wheels on a Post

By Milton Wright

A tool grinding stand of the kind universally used in machine shops for sharpening tools as well as a multitude of other purposes can be bought with a base suitable to bolt on to a bench; but a bench is rarely a convenient location in which to use it, so it is generally provided with a pedestal to stand on the floor at the place where it can be of the greatest service without being too much in the way.

Motor driven tool grinders, too, are too recent to be a part of the equipment of any old-established shop, so the belt-driven, pedestal-supported machine can be found in great numbers wherever there are tools to be sharpened. The picture shows how one shop is converting



Grinding wheels on a post

its old belt-driven grinding stands into modern, electrically-driven machines at practically no cost, except for the price of the motor, and in these days of washing machines and other electrically driven household appliances, a motor does not cost much.

All that is necessary to make the conversion, is a couple of angle plates and some bolts and straps. If the roof- or floor-supporting posts of the shop happen to be of structural steel, so much the better, but the angle plates can be strapped to any old kind of a post without difficulty.

With the motor on the upper angle plate and the wheel head on the lower one, and a piece of belt to connect them, the outfit is ready for business. The pedestal from which the grinder was removed, with a bench vise mounted upon it, makes an excellent reaming stand for the erecting floor.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Some Information on Taps

Q. Please advise us concerning the proper number of flutes for taps to be used to thread holes in aluminum, steel and cast iron between the sizes of ¼ in. and ½ in. We would also like to know something of the causes and the remedies for tap "loading."

A. A table has been prepared by one of the tap manufacturers which lists the recommended number of flutes in the tap for the materials and sizes you name as follows:

SIZE	ALUMINUM	STEEL	CAST IRON
¼	2	2	2 or 4
5/16	2	2 or 3	2 or 4
⅜	2 or 3	3 or 4	3 or 4
7/16	2 or 3	3 or 4	3 or 4
½	2 or 3	3 or 4	4
⅝	4	4	4

Loading, or the adhering of the material being tapped to the threads of the tap may be caused by lack of proper lubrication, by an incorrect design of tap for the work to be done, or by the use of a tap drill that is too small.

The size of the hole is the first point to check. If this is found to be correct, lubrication should be investigated on the basis that an insufficient amount makes no improvement over running the tap dry.

Water, cutting compounds, and soda water help the work, but they cannot be guaranteed to give the best results in unusually tough material, and mineral oils are not good for use in tapping steel.

If the tap on which loading has occurred is a new one, the difficulty may be found in its not being thoroughly lubricated at the start. Using a good grade of lard oil on a new tap is excellent practice to assist in "breaking-in" the tap.

Trouble with Packing

Q. In the shop where I am employed, a good deal of trouble is being had with the packing on a locomotive piston that continually burns out. Is there any formula for making packing out of lead, babbitt, tin or any other metal for piston-rod or valve-stem packing?

A. We suggest, as the first step for you to take in eliminating the trouble that you ascertain the name of the manufacturer of the packing you are using and put the problem up to him.

If the maker is one of the principal manufacturers in this line of business, you will find that he supports an expert service-engineering department which will make recommendations and tell you why your trouble is occurring.

We do not suggest that you try other kinds of packing until you have given this particular manufacturer a chance to show you what can be done with what you are now using, or with a somewhat different brand of his own manufacture.

In any event, we warn you against attempting to manufacture a packing yourself, since, with the number of manufacturers that are in this field as specialists, your time and the expense you would be put to would be practically all wasted, to say nothing of the danger of injuring the machinery on which you might apply a "home-made" packing.

Holding Irregular Shapes on a Magnetic Chuck

Q. Can you suggest an effective way of holding irregularly shaped pieces of cast iron on a magnetic chuck? We have tried all sorts of spacing bars and pieces without success.

A. Under favorable conditions, it is possible to bed the irregular pieces in iron filings, or, preferably, in chips slightly larger than filings. The chips should be placed on the chuck and the pieces bedded carefully before the current is turned on. When the chuck is magnetized, the pieces will be held firmly enough to permit the taking of any ordinary grinding cuts.

Casehardening a Shaft Locally

Q. Please give us information on the way you would recommend to caseharden a shaft in certain portions of its length without affecting other portions which we desire to remain soft. The shafts are approximately 20 in. in length, and there are two areas we want casehardened, each about 3 in. in length and separated by 6 in. at the center of the shaft. The diameter is 1¼ in. on the hardened surfaces. The balance of the shaft is of the same diameter, but it is not important that it be held particularly close.

A. From your description, we understand that there will be two 3-in. hardened sections with a 6-in. soft section in the center and a 4-in. soft section on each end. We have secured the following suggestions from a reliable heat-treater in answer to your question, and are glad to forward them to you:

Start with stock a bit more than twice the depth of the casehardening over the finished diameter, and turn it down at the two sections to be hardened to within the grinding allowance of the finished price. Leave the other three sections the original size.

Then put the partly machined shafts through the carbonizing operation, but do not quench them. When they have cooled, return them to the lathe and complete the rough turning to bring the three high sections down to the same diameter as the two that are to be hardened. This will have the effect of removing the carbon-charged layer from the sections that are to be soft.

The shafts can then be re-heated to the proper temperature, quenched and ground to the finished size. This method requires some extra handling, but it obviates the necessity of protecting the sections, that are required soft, by banding or coating them, and it reduces the trouble due to warping.

Sizes of Standard Milling Cutters (Simplified Practice)

Coarse-Tooth Plain Milling Cutters

[Cutters of less than ¾-inch face have straight teeth. Cutters of ¾-inch face and over have spiral teeth. Cutters having nicked teeth are special. Coarse tooth plain milling cutters of carbon steel are special]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2½	2	1	3	5	1¼
2½	2½	1	3	6	1¼
2½	3	1	4	2	1½
2½	4	1	4	3	1½
3	2	1¼	4	4	1½
3	2½	1¼	4	5	1½
3	3	1¼	4	6	1½
3	4	1¼			

Metal Slitting Cutters

[Metal slitting cutters are ground concave on the sides for clearance]

Diam. in Inches	Thickness	Size of Hole	Diam. in Inches	Thickness	Size of Hole	Diam. in Inches	Thickness	Size of Hole
2½	1/32	⅞	4	3/64	1	6	3/32	1
2½	3/64	⅞	4	1/16	1	6	1/8	1
2½	1/16	⅞	4	3/32	1	6	1/8	1¼
2½	3/32	⅞	4	1/8	1	6	1/8	1
2½	1/8	⅞	4	3/32	1	6	3/16	1¼
2½	1/32	⅞	4	1/16	1	7	1/16	1
3	1/32	1	5	1/16	1	7	3/32	1
3	3/64	1	5	3/32	1	7	1/8	1
3	1/16	1	5	1/8	1	7	1/8	1¼
3	3/32	1	5	1/8	1¼	7	1/16	1¼
3	1/8	1	5	3/32	1	8	1/8	1
3	1/32	1	5	1/16	1	8	1/8	1¼
4	1/32	1	6	1/16	1	8	1/16	1¼

Woodruff Keyseat Cutters

[These cutters are regularly furnished right hand only. Left-hand cutters are special]

Cutter Number	Diameter of Cutter	Thickness	Whole Length	Diameter of Shank
1[1]	½	1/16	2 1/16	¼
2[1]	½	3/32	2 3/32	½
3	½	1/8	2¼	½
4	⅝	3/32	2 3/32	½
5	⅝	1/8	2¼	½
6	⅝	3/32	2 3/32	½
7	¾	1/8	2¼	½
8	¾	3/32	2 3/32	½
9	¾	1/16	2 1/16	½
10	⅞	3/32	2 3/32	½
11	⅞	1/16	2 1/16	½
12	⅞	3/32	2 3/32	½
A	⅞	¼	2¼	½
13	1	1/16	2 1/16	½
14	1	3/32	2 3/32	½
15	1	¼	2¼	½
B	1	1/16	2 1/16	½
16	1⅛	3/32	2 3/32	½
17	1⅛	3/32	2 3/32	½
18	1⅛	¼	2½	½
C	1⅛	1/16	2 1/16	½
19	1¼	1/16	2 1/16	½
20	1¼	3/32	2 3/32	½
21	1¼	¼	2½	½
D	1¼	1/16	2 1/16	½
E	1¼	5/16	2 5/16	½
22	1⅜	¼	2½	½
23	1⅜	1/16	2 1/16	½
F	1⅜	5/16	2 5/16	½
24	1½	¼	2½	½
25	1½	1/16	2 1/16	½
G	1½	5/16	2 5/16	½

[1] Not made of high-speed steel.

Side Milling Cutters

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2	3/16	½	4	½	1¼
2	3/16	5/8	4	5/8	1
2	¼	½	4	5/8	1¼
2	¼	5/8	4	¾	1
2	3/8	½	4	¾	1¼
2	3/8	5/8	4	⅞	1
2½	¼	⅞	4	⅞	1¼
2½	5/16	⅞	5	½	1
2½	3/8	⅞	5	½	1¼
2½	7/16	⅞	5	5/8	1
2½	½	⅞	5	¾	1¼
3	¼	1	5	¾	1
3	5/16	1	5	¾	1¼
3	3/8	1	5	1	1
3	7/16	1	5	1	1¼
3	½	1	6	½	1
3½	7/16	1	6	¾	1
3½	½	1	6	¾	1¼
3½	9/16	1	6	1	1¼
3½	⅝	1	7	¾	1¼
4	¼	1	7	1	1¼
4	3/8	1	8	1	1¼
4	½	1			

Coarse-Tooth Side Milling Cutters

[Coarse tooth side milling cutters of carbon steel are special]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
3	⅜	1¼	4	⅞	1½
3	7/16	1¼	5	¾	1¼
3	½	1¼	5	¾	1½
4	½	1¼	5	⅞	1¼
4	½	1½	5	⅞	1½
4	⅝	1¼	5	1	1½
4	⅝	1½	6	¾	1½
4	⅞	1¼	6	1	1½
4	¾	1¼	8	1	1½
4	¾	1½			
4	⅞	1¼			

Plain Milling Cutters

[Cutters or less than three-fourths inch face have straight teeth. Cutters of three-fourth inch face and over have spiral teeth. Cutters having nicked teeth are special]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2¼	½	⅞	3	¼	1	4	¼	1
2¼	1	⅞	3	3/16	1	4	¼	1¼
2½	3/16	1	3	⅜	1	4	5/16	1
2½	¼	1	3	⅜	1¼	4	5/16	1¼
2½	5/16	1	3	⅜	1¼	4	⅜	1
2½	3/8	1	3	½	1¼	4	⅜	1¼
2½	7/16	1	3	⅝	1¼	4	7/16	1¼
2½	½	1	3	¾	1¼	4	½	1¼
2½	5/8	1	3	⅞	1¼	4	5/8	1¼
2½	¾	1	3	1	1¼	4	¾	1¼
2½	⅞	1	3	1¼	1¼	4	⅞	1¼
2½	1	1	3	1½	1¼	4	1	1¼
2½	1¼	1	3	1¾	1¼	4	1¼	1¼
2½	1½	1	3	2	1¼	4	1½	1¼
2½	1¾	1	3	2½	1¼	4	2	1¼
2½	2	1	3	3	1¼	4	3	1¼
2½	2½	1	3	3½	1¼	4	4	1¼
2½	3	1	3	4	1¼			
2½	4	1	3	5	1¼			
3	3/16	1	3	6	1¼			

(To be continued)

Recommended by the Bureau of Standards and approved by individual concerns, associations and other groups. The recommendations become effective Jan. 1, 1926, and are subject to regular annual revision.

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Technical Abstracts

Heat-Treating Aluminum Alloys

Samuel Daniels, chief of the metals branch, engineering division of the Air Service, Dayton, Ohio, states that among the light materials commonly used for pistons and other parts operating at elevated temperatures is an alloy with aluminum, 88.5 per cent; copper, 10 per cent; iron, 1.25 per cent and magnesium alloy, 0.25 per cent. Ordinarily this has been employed in permanent-mold casting, affording pistons which are closer to size and weight tolerances than those produced by sand-casting, a much slower and less economical though satisfactory method of manufacture. The possibilities in the heat-treatment of this alloy have not been widely appreciated and it is often the practice to place pistons in service in the cast condition.

The strength and hardness of aluminum may be increased to about 35,000 lb. per sq.in. and 120 Brinell hardness by a heat-treatment at 925 deg. F. for 5 hr., quenching in boiling water and aging at 300 deg. F. for 16 hr., and at 400 deg. F. for 2 hr. — *Forging-Stamping-Heat-Treating*, Oct., 1925, p. 346.

Belting

William Staniar of the du Pont de Nemours & Co. in stating an obvious fact that the right belt in the right place will give correct transmission discusses the question of what is the right belting. It requires power to make a belt slip over a pulley, and stretch is the foundation of slip, therefore, the right belt reduces this factor to a minimum and less power is required. Selection of the belt should be made for a specific purpose. Stretch and premature failure are the cause of high transmission-maintenance costs because stretch necessitates frequent belting adjustments and premature failure calls for labor in replacing the destroyed power medium. The right belt obviates this difficulty to a great extent and can hold maintenance cost to a minimum. Belt joining also has a great effect on lowering maintenance cost. Correct belt transmission has a strong influence on production costs and efficiency because practically all production machinery is dependent on continuous belting service. For this reason great care should be taken in belt selection. — *Industrial Management*, Oct., 1925, p. 218.

Shop Committees

The aims of employee representation are to bring grievances to the attention of company officials, to advise regarding, and perhaps administer, welfare and service activities, to educate workmen in matters of mutual interest, and to negotiate wages and general working rules. John W. Riegel, of the Harvard Graduate School of Business Administration, discusses these points and makes recommendations. There are three methods of grouping employees for the purpose of representation: First, to apportion representatives to departments or divisions of the plant; second, is to apportion representatives to crafts; and third is representation at large.

In discussing committees, Mr. Riegel states that one of the chief advantages of a large committee is the opportunity afforded to many persons in the organization to serve upon it, but it has disadvantages in that many members hesitate to express themselves in its sessions. A small committee is fitted to negotiate wages and working conditions since its procedure can be informal and expeditious.

A question associated with the proper size of committees is that pertaining to the ratio to be maintained on the average between the number of constituents and each representative. At the Lynn plant of the General Electric Co., for example, the small executive committee and a reasonably low ratio of representation are both obtained by having a conference, made up of all employee representatives, selected from the employee members of standing joint committees. — *Harvard Business Review*, Oct., 1925, p. 17.

Molybdenum and Vanadium in Tool Steels

Two German engineers, Rudolph Hohage and Arthur Gruetzner, report on some tests undertaken at Krupp's to determine the relative influence of vanadium, molybdenum and tungsten on tool steels. It appears from these tests that the three alloying materials can replace one another to some extent. Thus, if to a steel containing 12.4 per cent tungsten and 0.52 per cent vanadium is added 4 per cent molybdenum, the performance of the steel equals that of one with 18.70 per cent tungsten and 0.49 per cent vanadium. In other words, 4 per cent molybdenum is as good as 6.3 per cent tungsten in this particular case. Four per cent molybdenum, however, produces no improvement in a steel with 13.8 per cent tungsten and 1.6 per cent vanadium.

If we, therefore, regard 0.8 per cent vanadium as normal, the authors find that 23 per cent tungsten represents the maximum amount needed to produce an improvement. Higher percentages have no effect. One per cent tungsten can be replaced by 0.12 per cent vanadium. A steel with 23.8 per cent tungsten and 1.48 vanadium has either 0.9 per cent too much vanadium or 7 per cent too much tungsten. The maximum performance can be obtained either with 16.8 per cent tungsten and 1.48 per cent vanadium, or with 23.8 per cent tungsten and 0.58 per cent vanadium. Molybdenum causes sparse-grained structure if the temperature is above 1,100 degrees C.— *Betriebstechnik*, Sept. 15, p. 835.

Safety Work

In organizing for the prevention of accidents, industrial managers are apt to forget that the foreman is the one man responsible for the safety of his department, says George Hodge. The safety organization composed of the safety department and all committees simply represents a service department to assist the foreman in meeting his obligation.— *Iron Trade Review*, Oct., 15, p. 961.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

We Have a Birthday

FORTY-EIGHT years ago this month the first slim and modest issue of the "American Machinist" made its appearance. Compared to the weekly issues of today the first monthly issue of 1877 was a very slender infant but it was vibrant with the same spirit of earnest endeavor for the well-being of the machine industry that animates it now and has made it a power in its field throughout its life.

Many editors and business managers have arisen, grown old in the service and passed on during these forty-eight years but the paper itself seems to grow younger and more robust as the years pass. As its early readers rose from machinists to be managers, superintendents and owners of companies, the "American Machinist" grew with them, changing its contents to meet their different requirements and adjusting itself to render them maximum service.

And why should it not grow younger? Each succeeding year brings more mechanical wonders: The conquest of the air; almost unlimited wireless communication; steady progress in the release of mankind, by mechanical means, from the back-breaking, soul-killing tasks; the transformation of the luxuries of the last generation to the common necessities of this, and the introduction of new comforts and conveniences undreamed of by our fathers. As a faithful chronicler of the development of the methods and equipment that have made these advances possible the "American Machinist" has of necessity stayed young. It must needs do so to keep pace with its field, and that it will do, as always.

An Effective War Deterrent

THE American Legion proposes a universal draft law as an effective war deterrent. By the terms of the proposed legislation the President would be given power to draft fighting men, factories for production, men and women war workers, money to finance belligerent operations, and control of transportation, farm products and their prices.

Here is a pretentious and comprehensive program indeed. Some skeptics might even call it preposterous. But there is a germ of sound common sense at the heart of it. If it could be worked out and applied equally to all the major powers there is small chance that we would ever again witness a devastating struggle like the world war. Even if it could be made effective in the United States alone there is good reason to believe that the assurance that a country with the resources and man-power of this one could mobilize so completely at the call of its leaders would prevent aggression.

How the details can be worked out is another matter and one of tremendous difficulty. If the proposed legislation really gets to the point of serious consideration in Congress a war of words will ensue that will engage those honorable gentlemen for many weeks. The chances seem to be favorable for a stalemate but at least the vital need of planning to prevent war will have been brought again to the public mind and that is highly desirable.

Should Improvements Follow Demand?

IT IS quite a problem for any machine builder to determine how far to go in adopting new designs and improvements in his products. As some of our pioneers know all too well, it takes time and money to educate the buyer and user to the point of purchasing a radically new machine. This condition has, however, changed for the better during the past few years.

A case in point is the introduction of ball and roller bearings in machine tools. We see evidence of their increasing use on every side. The question for the machine builder is whether to introduce them ahead of demand of customers or wait for the demand to make itself felt.

Many machine tool users are demanding the use of these types of bearings as a remedy for delays in production due to bearing failures. Having seen the advantage of ball and roller bearings they are quite willing to pay any increased cost that may be necessary.

From one angle this is the easiest procedure as the customer sells himself the idea. The disadvantage is that the builder who does not wait for the customer's demand may get the orders.

American Automobiles Abroad

LATEST reports show that exports of American automobiles and trucks for the first nine months of this year exceed the total for the whole of 1924. Estimates based on present trends and past experience indicate that when the year is ended the totals will be better than forty per cent ahead of last year.

The production and domestic sales records of the automotive industry are impressive enough this year. When reinforced by the export figures they become truly remarkable.

Shop Equipment News

Attachments for Davenport 5-Spindle Automatic Screw Machine

The standard 5-spindle automatic screw machine, being built by the Davenport Machine Tool Co., Rochester, N. Y., for high-speed production work on brass and steel products, was described on page 714, Vol. 63, of the *American Machinist*. Attachments have recently been made available by which the range and adaptability of the machine are increased. A set of attachments mounted on the machine is shown in Fig. 1. Because these attachments are typical, their functions and operations are explained in this description by following through the details of the production of the small brass part illustrated by Fig. 2, which is machined in 5 seconds.

On Fig. 3, a front view from the right-hand end, and on Fig. 4, a rear view, letters have been placed to conform with the description. It should be understood that the letters from *A* to *I*, inclusive, denote work positions rather than individual parts. These positions are lettered where they can be seen.

The attachments consist of four auxiliary spindles with their driving and feeding mechanisms, an auxiliary, 5-point, work-carrying spider arranged to advance in step with the indexing movements of the main head, an arrangement of the standard spindles so their rotation can be stopped and started and a work ejector for the finished pieces.

Two of the auxiliary spindles are located vertically on the work-head housing at work position *D* of the five standard positions known as *A*, *B*, *C*, *D* and *E*, through which the work starts and progresses in the order named. One of these spindles carries a drill, while the other, which is arranged to pivot vertically on the drill-spindle drive, carries a saw, rotating in a horizontal plane, to do the slotting operation. The two other auxiliary spindles are mounted horizontally at the front of the work-head housing. One of them performs the external threading and the other drives the milling cutter to machine the keyway on the externally threaded end.

The spider picks up the pieces as they are parted from the bar stock in the final standard position *E*, passes them through an idle position *F*, the external-threading position *G*, and the keyway-milling position *H*, to the finished-ejection point *I*. From there, the completed parts fall to a delivery chute at the rate of one each five seconds.

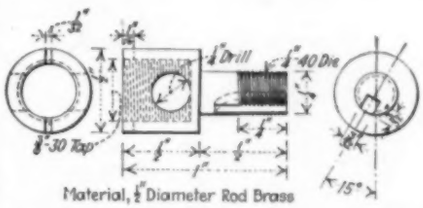

Fig. 2—Cross-section layout of the work performed

The operations on the piece, in the order and at the positions they are performed, are as follows:

The bar stock is started forward immediately after the cut-off has been completed at position *E*. It comes to rest against the limit stop attached to the work-spindle in position *A*.

Position A—Limit feed of stock from stop on *A* tool-spindle and rough drill from *A* tool-spindle.

Position B—Form neck from rear tool-slide and finish-drill from *B* toolspindle to square bottom of hole.

Position C—Size neck from rear toolarm and tap from *C* toolspindle.

Position D—Cross-drill and slot from auxiliary, vertical toolspindles.

The work spindle has been brought to rest while indexing took place from positions *C* to *D* by means of a cam action in the head which throws out a clutch between the spindle approaching *D* position and its driving pinion.

The drill is fed down and returned and the slotting saw is swung on its pivot to feed into and away from the work by means of an arrangement of rack and pinions. The rack

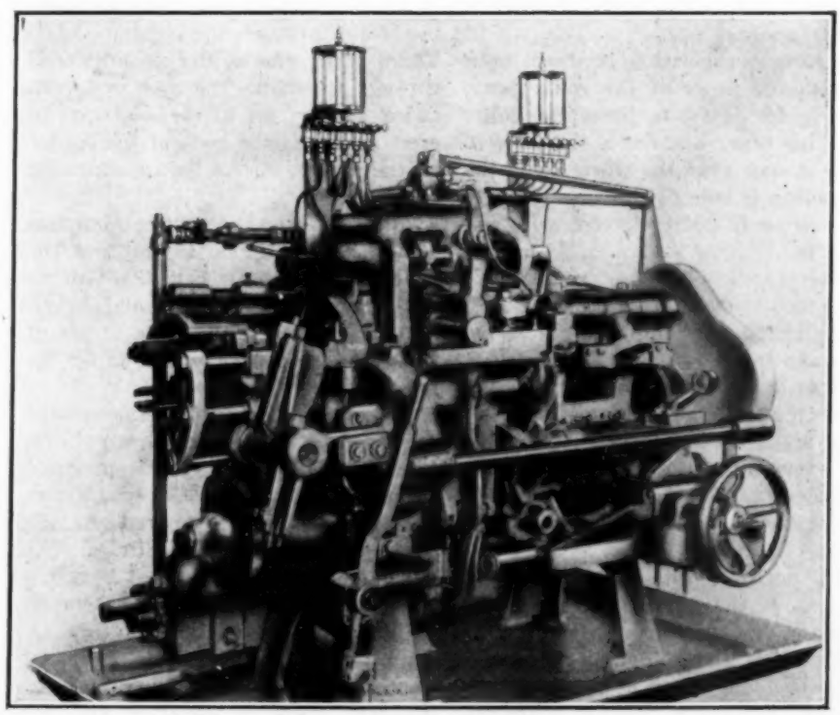

Fig. 1—Davenport 5-Spindle Automatic, Screw Machine with Attachments

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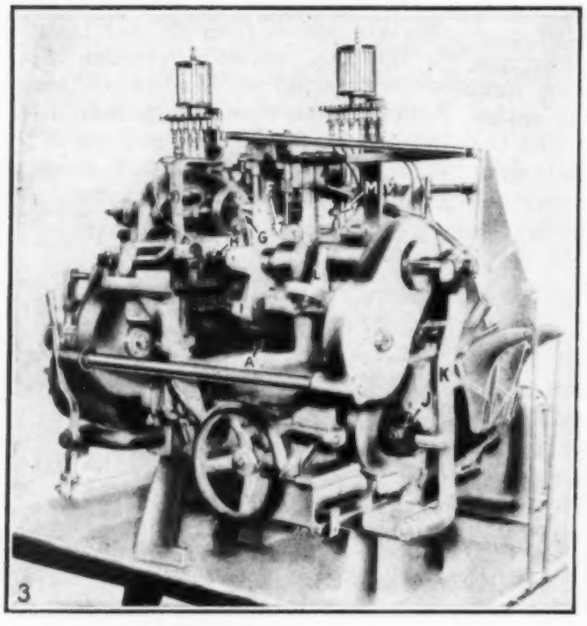
is actuated by a reach rod connected to the same cam arm that controls the movements of the toolspindle in *D* position.

While the head indexes between *D* and *E* positions, the clutch on the work spindle is again engaged by a cam action so the spindle is rotating at full speed at *E* position.

Position E—Cut off from front toolarm and pick up separated piece from a drive at the rear of the machine that will be described later.

The advance and retreat of the spindle are actuated from the same cam arm, that is used for actuating the tap on the internal threading in position *C*, by means of a reach rod from the arm and an arrangement of lever arms mounted above the work-head housing.

The spider, in advancing into this completely before the spider must index. Further, due to the division and timing of the movements, the ejection must take place while the spider is advancing and retreating. The operation is accomplished by mounting the ejector at the end of a rack that meshes with a gear assembly inside the housing at *L*, Fig. 3. One gear at the bottom meshes with the rack and is twice as



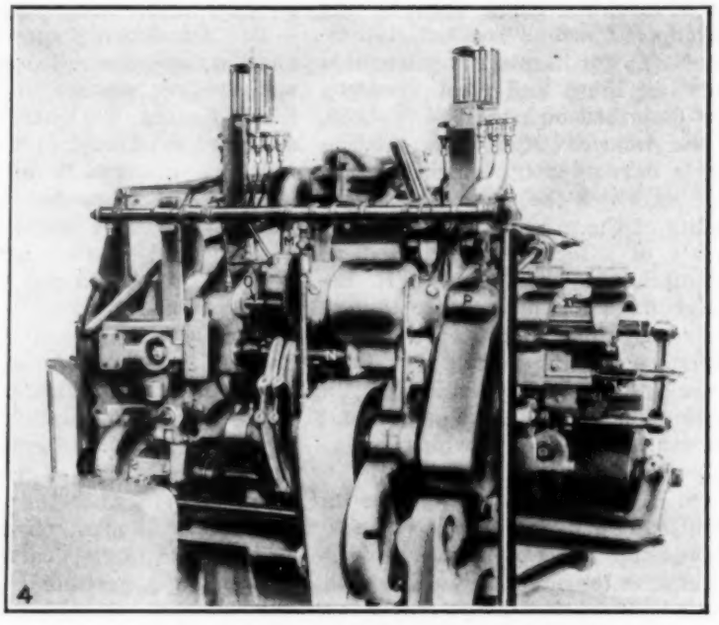


Fig. 3—A front view from the right-hand end. Fig. 4—A rear view showing the auxiliary-spindle drives

in collet holder fitted in arm of spider.

Position F—Idle.

The piece held in its collet in one of the arms of the spider is advanced by the indexing of the spider to a position where it makes contact with a flat spring on the machine housing. The spring presses it back into position in the collet. This collet does not grip the part tightly, but retains it in a running fit. The action registers the slot in the work in position in the collet.

The movement of the spider is a combination of rotary motion actuated from the indexing drive and reciprocating movement as controlled by the cam *J*, and the cam arm *K*, attached to its shaft by means of a sleeve. Thus, the spider advances, picks up the piece at *E* position, retreats, indexes and again advances.

Position G—Cut external threads from *G* toolspindle.

This toolspindle is driven forward and is reversed in a unique manner position, enters the work through a steel plate in *G* position. The hole in this plate is tapered to conform with the outside taper of the collet jaws. The spider is set to press the collet into this taper and cause the jaws to close in and grip the work while the threading is being performed.

Position H—Mill slot from *H* toolspindle.

The spindle is driven from a spur gear that meshes with the ring-gear drive to the workspindles. It is fed forward and returned by another system of levers connecting through a reach rod from the same cam arm that actuates the *D* toolspindle and the vertical drilling and slotting spindles.

Position I—Eject the finished piece.

To perform this operation, it is necessary that the ejector pin, in position *I*, enter through the hole in the rear of the spider and protrude from the collet jaws at the front. It is also necessary that it withdraw large as another gear that engages teeth cut around the spider shaft. Thus, when the spider is advanced through its stroke the rack is driven twice as far, an ample distance to eject and clear the back of the spider on the return stroke before indexing occurs.

The drive for the vertical spindles comes through a gear assembly at the rear of the machine, Fig. 4, which includes the vertical-shaft and bevel-gear assemblies at *M*. The origin of the drive is from a pinion on *N*, the main drive shaft.

The position-*G* threading-spindle drive, already mentioned, combines the vertical-spindle, constant-speed drive and a variable-speed drive-shaft *O* which is geared to the position-*C* tapping-spindle drive. The arrangement is indicated at Fig. 5, a line drawing of this drive assembly.

The company designates this assembly the "Jack-in-the-Box," an apt expression. The drive combines the constant speed of shaft *N* and the

SHOP EQUIPMENT NEWS

variable-speed but constant-direction rotation of shaft *O* to result in a forward and reverse rotation of the resultant drive which connects to the threading spindle through the bevel gears *P* and the shaft extending to the front of the machine.

A pinion on shaft *M* drives a gear *Q* that is securely fastened to the sleeve on which it is shown. The flange on this sleeve is, in turn, secured to the cylinder *R* and the flanged sleeve *S*, so that all rotate as a unit.

At the left-hand end of sleeve *S*, a bevel gear is secured to drive its mating gear to rotate the vertical, shaft *M* leading to the vertical spindles at position *D*. The sleeve *S* is carried in bearings on the machine, as is the sleeve to the right. The shaft *O*, to the left, and the corresponding shaft *T* to the right are free to rotate within their sleeves as bearings.

There are bevel gears mounted on the ends of shafts *O* and *T*, inside the cylinder *R*. These gears mesh with two others that are free to rotate on pin bearings secured in bosses inside the cylinder rim. These pins are carried around by the cylinder as it rotates, the whole assembly being in effect a differential. The four pinions in the assembly are all of the same size.

The tapping action at position *C*, to which shaft *O* is attached, involves driving at two speeds, but in the same direction. The slow speed at the tap is slower than the rotation of the workspindle and in the same direction. This, of course, causes the tap to advance and cut the threads. The fast speed, secured when the tapping clutch is shifted, drives the tap in the same direction, but faster than the workspindle is rotating. This causes the tap to back out of its completed threads. The resulting speeds of shaft *O* are 1,343 r.p.m. and 2,818 r.p.m., respectively, both clockwise.

The problem is to transform these two speeds into a reversing drive which is necessary to thread the work as it is held stationary at the *G* threading position.

Shaft *N* rotates at 2,127 r.p.m. in a counter-clockwise direction. This drives gear *Q* and the assembly at *R* in a clockwise direction at 880 r.p.m., due to the reduction between the pinion and the gear.

With a little study and application of the differential principle, it will be seen that when shaft *O* revolves at 1,343 r.p.m., the bevel gears within the assembly will transfer rotation in the same clockwise direction to shaft *T* at 417 r.p.m. This advances the die at the same speed to cut the threads at position *G*, since there is no further speed change in the bevel gears carrying the drive to the front of the machine.

When, however, the speed of shaft *O* is increased to 2,818 r.p.m. by the shifting of the position-*C*, tapping-spindle clutch, the rotation of shaft *T* will be reversed to a counter-clockwise direction at 1,058 r.p.m., and the threading die will consequently back off from the thread it has completed.

The machine is arranged with the point in view of being able to fit it for special applications with but little alteration. Provision has been made for adding the extra spindles and for attaching the drives.

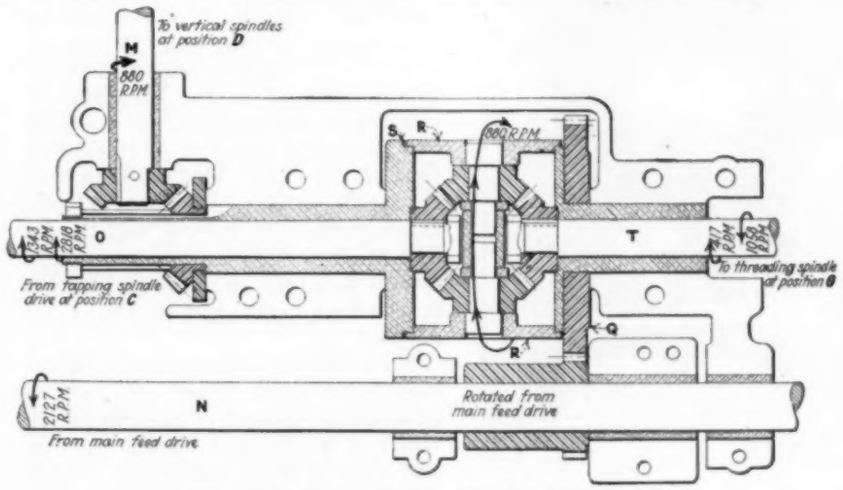
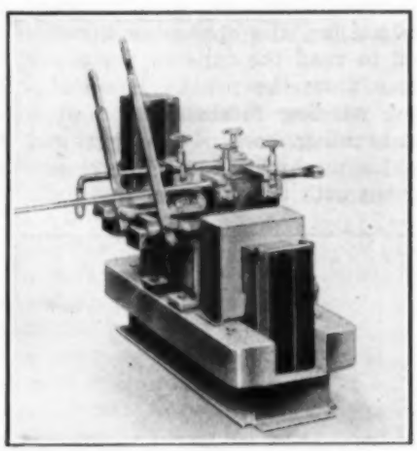


Fig. 5—Layout of the "Jack-in-the Box"

"American" Electric Bar Welder

The "American" electric bar welder, illustrated, essentially is similar in its design and construction to the electric ring heaters being built by the company and to the electric rivet heaters described on page 796, Vol. 63, of the *American Machinist*. It is being marketed by the American Hoist & Derrick Co., St. Paul, Minn. The machine is intended for heating bars to be butt-welded to other bars or to steel castings.

The unit is mounted on a base constructed of I-beams and is sufficiently light to be easily transported on a platform truck. Advantages claimed for this heater are that all high voltage is locked inside the heat control box and that the only high heat is centralized at the point of welding. The operation of the machine is simple so that training is unnecessary. The equipment contains two sets of heating units.



"American" Electric Bar Welder

The holders form parts of the complete magnetic circuit which is closed when the two holders are brought together by means of the lever. As soon as the movable holder is advanced with the piece clamped in it the magnetic circuit heats up the parts. The welding is completed as soon as the welding heat is reached by forcing together the ends of the bars.

SHOP EQUIPMENT NEWS

"Davey" Vibroscope

The vibroscope, developed by Peter Davey and marketed by E. M. Sawtelle, 11 Broadway, New York, N. Y., is designed to aid in the solution of problems arising in the operation of high-speed mechanisms. The vibroscope, which operates on the stroboscopic principle, causes rapidly moving parts to appear stationary or in slow motion, as desired, so that their cycles can be studied and faults corrected.

The apparatus, shown in Fig. 1, can be used to advantage in the study of valve lift in gasoline engines; the vibration, lubrication and operation of gears; electric relays and various contacting devices such as magnetos; grinding-wheel contact conditions with the work; speed of textile spindles and traveler action; and steam turbine vibration. In application to printing-press mechanisms, the apparatus may be used to read the type as the paper passes from the press. Lamp filament winding mechanisms, sewing and braiding machine operation and packing machinery can all be closely studied with the vibroscope. In addition to these applications mentioned, there are numerous other uses to which the instrument may be put.

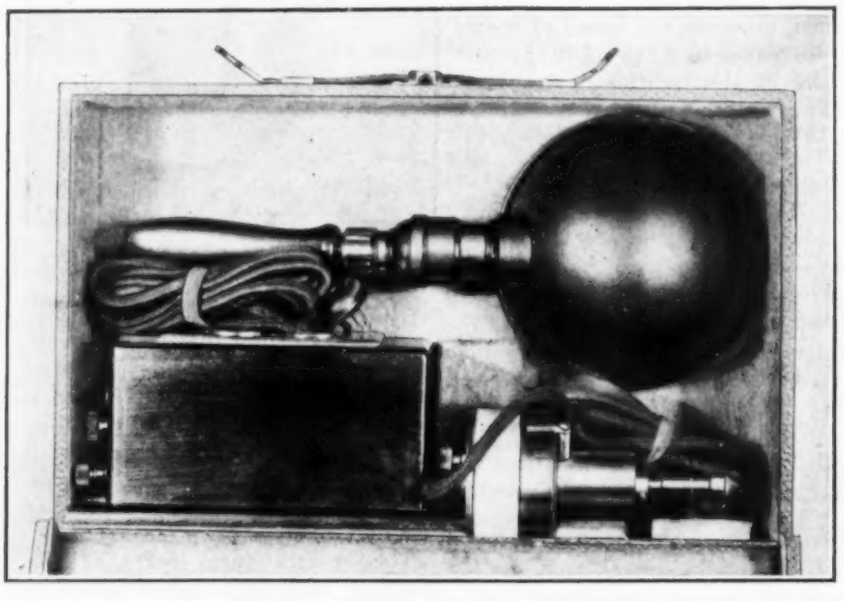


Fig. 1—"Davey" Vibroscope

The vibroscope consists essentially of three parts, a special lamp which supplies the flashes upon which the operation of the instrument depends, a transformer to provide the high voltage necessary for the lamp and an interruptor which is driven direct from the machine under examination and controls the timing of the flashes.

In operation, the interruptor is synchronized with the moving parts of the machine under examination so as to cause the lamp to flash as the mechanism studied repeatedly reaches a certain point. The lamp which is used for this work has a special neon tube capable of giving single flashes of extremely short duration. The lamp is provided with an extension cord so that it can be directed upon any part of the moving machine.

The human eye has a tendency to retain the picture presented by one flash until it is followed by the next. If the flash is repeated each time the moving object reaches a certain point in its cycle, the object will appear to be standing still. If the light flashes are slightly out of synchronism with the operation of the mechanism observed, a slow motion effect will be produced as each flash catches the mechanism a little further in its cycle. If the frequency of the flashes is double the speed of operation of the moving part, there will be a double image in the two extreme positions.

The transformer, which draws its power from three dry cells, has convenient terminals for leads from the lamp and the interruptor.

The interruptor closely resembles a hand tachometer and may be driven in a similar manner by either steel or rubber points. The spindle of the interruptor with a rubber point can be seen in Fig. 2. The steel point is used for positive drive

Fig. 2—The operating position

and the rubber point can be used to allow slipping in the drive when desired so as to create the slow motion effect. The pressure exerted on the rubber point will determine the rate of creep or slip and thus control the apparent speed of the object.

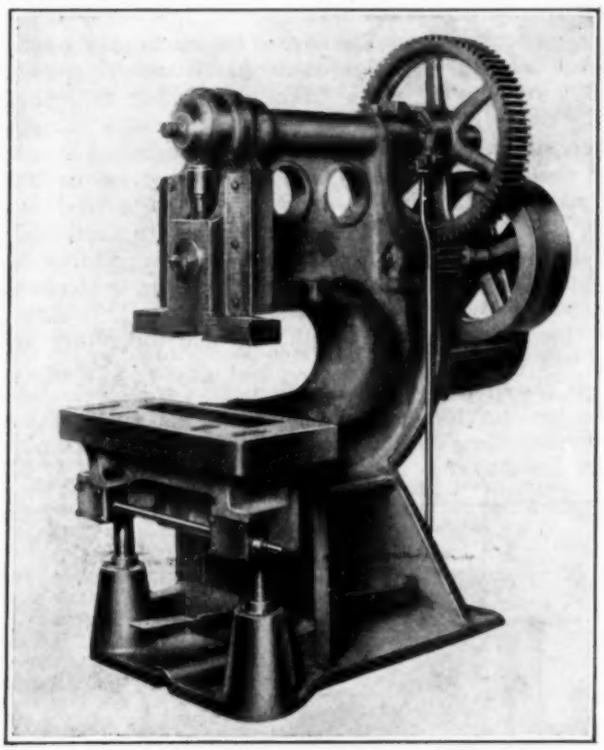
The interruptor is composed of two concentric cylinders. The larger one can be rotated on the smaller. It is knurled and has a dial marked in 360 deg. by which the speed of cycles or fractions of cycles can be determined. If the outer portion is held in one position and the inner cylinder turned in the direction of rotation of the machine, the machine will appear to follow it in the direction of rotation. The machine will appear to rotate backwards if the inner portion is turned backwards. The inner portion may be drawn out to two positions so as to give either two or four flashes per revolution as desired.

A special motor drive has been designed for cases where no shaft is available to drive the interruptor or where a slight load on the spindle will slow it down below the normal speed. Means are provided for fine speed regulation and clips to carry the vibroscope interruptor and a tachometer. The three component parts of the apparatus fit into a case, making a readily portable outfit weighing about 10 pounds.

SHOP EQUIPMENT NEWS

"Semco" Special Adjustable-Bed, Deep-Throat Press, PA-25½

The "Semco" deep-throat press, PA-25½, manufactured by the Service Machine Co., 160 Miller St., Elizabeth, N. J., is equipped with a special heavy adjustable bed to accommodate deep coping dies such as are used for cutting openings in steel door bucks and hollow-steel moldings and for mitering joints. The bed is 36x16 in. so that large flat blanking and trimming dies can be used. Special adaptability is claimed in that the deep throat has been combined with the adjustable bed.



"Semco" Special Adjustable-Bed, Deep-Throat Press, PA-25½

Stiffness in the body of the press is secured by a heavy back deflection rib. Two holes through the upper back web make it possible to sling the press on a chain. To insure against clicking, the clutch is provided with a reacting spring-cushioned switch that withdraws the sliding bolt from engagement and then kicks it about ⅛ in. clear of the three contact pins.

Interchangeable eccentrics allow short or long strokes, when desired. The standard rating of stroke is 1½ in. The rams may have extended side wings 20 in. in width and dovetail or shank die holders. The range of slide adjustment is 2 inches.

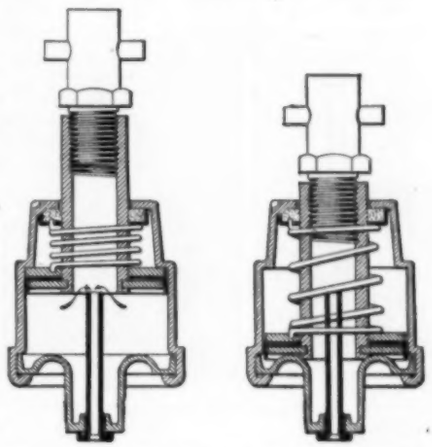
The bed of the press is mounted on two 2¼-in. screws coupled through worm gearing to the crank and it can be dropped 6 in. below the normal level. Four clamping bolts lock the bed at the desired setting. Open belt or gear drive, as illustrated, with tight and loose pulleys are available. A 6-to-1 ratio of gears is used.

The 2¼-in. adjustment and connection screws are made of high-carbon alloy steel. The shaft is a 2¾-in. alloy-steel forging. The floor space required is 26x54 in., the height is 6 ft. and the total weight is 4,500 pounds. The capacity of the press is sufficient for blanking holes 8½ in. in diameter in ⅜-in. steel, or the equivalent.

This press is an adaptation from the regular "Semco" P-25 model with a stationary bed. Where no loose pulley is desired on the drive of the press, a shaft bracket such as is illustrated is not furnished with the machine.

Greas-om-eter Automatic Grease Cup

An automatic grease cup, illustrated, has been developed and placed on the market by the Greas-om-eter Corporation, 460 Montgomery St., San Francisco, Calif. It consists of a piston mechanism actuated by a spring, and is provided with threaded ends to connect with a grease gun and a bearing opening, respectively. The grease, forced in under pressure, fills the container and compresses the spring to furnish a constant and regular supply of lubricant to the bearing delivered through a metering tube of small bore. The illustration



Greas-om-eter Automatic Grease Cup

shows the cup in the full and in the discharge positions.

Brass pins of varying thickness with flattened heads marked from 1 to 10, are available for insertion in the metering tube. When the grease discharge is excessive, a metering pin with a lower number can be substituted to control the supply. The metering tube is easily removable and changes can be made in the size of the pin until exact regulation is insured. The illustration does not show the pins.

Around the collar of the lubricator is a packing ring to exclude dirt and dust.

The cup is for general purposes and for all places where forced-grease lubrication is used.

Pedersen "Oiljak"

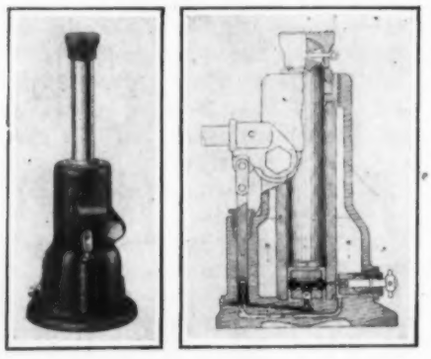
The Pedersen "Oiljack" placed on the market by the Oil Jack Co., Inc., 1457 Broadway, New York, N. Y., embodies the hydraulic principle of operation. A view of the jack is shown in the illustration and a cross-section is given to make clear the details of operation and the mechanism.

By raising a handle which fits into the socket *C*, the pump plunger *H* is raised, drawing oil from the reservoir *R* through the channel *N* and the ball-check valve *B* into the chamber *G*. Depressing the handle seats the valve *B* and forces the oil

SHOP EQUIPMENT NEWS

through channel *M*, the oil passing the ball-check valve and flowing into the chamber *A* to cause the plunger *L* to rise, according to the quantity of oil forced beneath it.

The load can be lowered by slightly turning the needle valve *D*. The



Pedersen "Oiljak"

outlet *E* is thus opened and the oil is permitted to return to the reservoir. The flow is under quick control, the opening at needle valve *D* regulating the speed of lowering. Closing the needle valve at any point of the plunger movement holds the load stationary. The oil in the reservoir is not under pressure. Chamber *A*, where the pressure occurs, is entirely surrounded by a steel jacket to protect it while under strain.

The swivel head is corrugated and hardened to insure a firm grip under the load. The ram is made of solid steel, 1⅜ in. in diameter, heat-treated and ground. Adjustable, oil-retaining packings are provided. The rocker arm is rigidly constructed and provided with a positive stop. It oscillates on a heat-treated fulcrum bolt and projects over the pump stem to protect it. The base is 6½ in. in diameter on this model so as to provide a rigid foundation.

The "Oiljak" is especialy adapted to "close-corner" operation since a full stroke of the handle is not necessary to actuate the lifting mechanism. Small strokes of the handle will be sufficient to raise the ram.

Another advantage claimed for the jack is the fact that its operation is smooth and nearly continuous, and that it can be stopped at any point whether lifting or descending.

A 10-ton "Oiljak" is now in production and 6-ton, 3-ton and 1-ton sizes will soon follow.

Pratt & Whitney Improved Die Sinkers Nos. 2 and 3

The Pratt & Whitney Co., Hartford, Conn., has brought out improved models of the No. 2 and No. 3 die sinkers, formerly described on page 532, Vol. 55 of the *American Machinist*. The No. 3 size is illustrated.

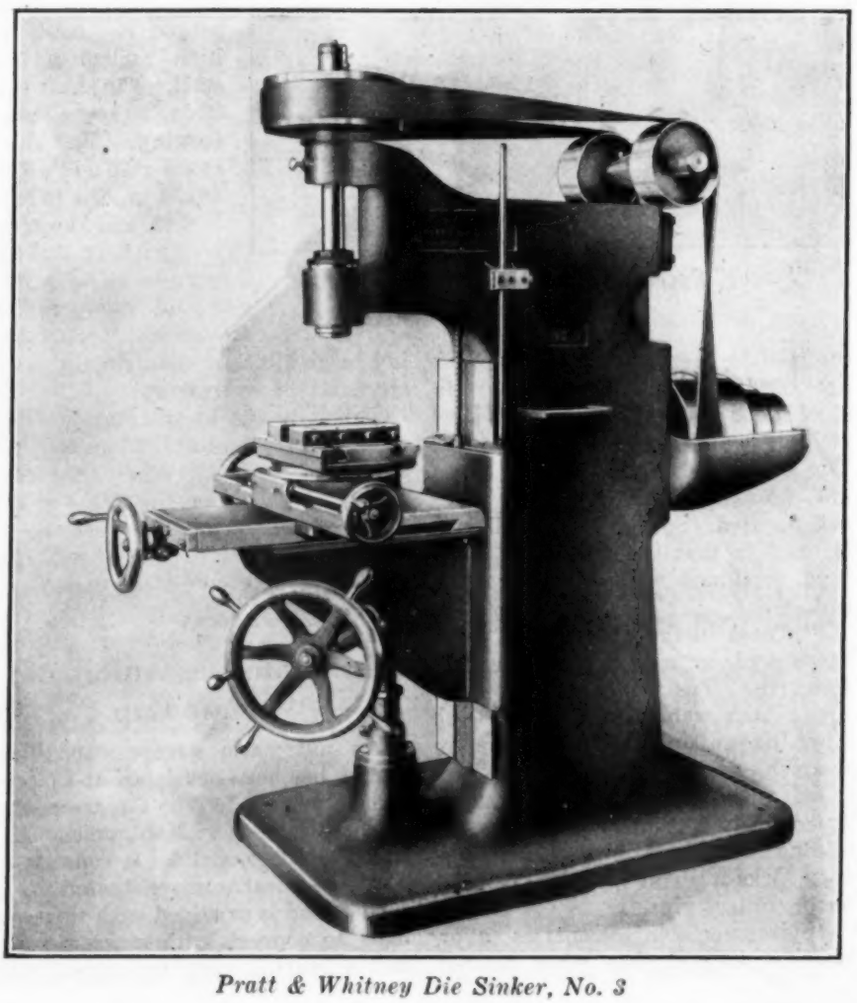
The entire machine has been made heavier and more rigid in order to be capable of standing up under more severe service than heretofore. An increase in weight of about 30 per cent is to be found mainly in the column. The wearing surfaces on the knee slides and the two table slides have been broadened to insure greater accuracy and less wear.

In order to adapt the machine more readily to either belt or motor drive, the cone pulley is placed in a higher position on the back of the column. At the same time the advantage of smooth belt drive to the spindle is retained. The idler pulleys carrying the spindle-driving belt are adjustable so that the tension on the spindle-driving belt can be regulated. These pulleys are equipped with oilless bearings.

The knee of the machine is counterweighted so that it will be easier to move from one setting to another and the elevating screw is equipped with ball thrust washers. A spindle-pulley lock is now provided to facilitate removal of the cutters and more spindle speeds are available.

The present design retains the large handwheels, the micrometer rings on the feed screws, the adjustable depth stop and the rotary vise feed.

The equipment available includes cutters, chucks, collets, a tilting circular vise, a cherrying attachment and cherrying cutters.



Pratt & Whitney Die Sinker, No. 3

News of the Week

Government Policy of "Open-Door" Trading Stressed at Exporters' Convention

President Nichols warns against the "favorable balance"

An emphatic denial of the charge that the United States has assumed an attitude of imperialism in world trade was made by Joseph C. Grew, Under Secretary of State, in an address delivered at the dinner which closed the sixteenth annual meeting of the American Manufacturers Export Association, held in the Hotel Astor, New York, Nov. 12. Practically the entire theme of the meeting, like Mr. Grew's address, was given to a profound analysis and discussion of export problems and relations with foreign countries. The government policy of "open door" trading was stressed by more than one speaker.

The banquet was a brilliant affair, attended by many notable government officials and heads of financial and industrial enterprises. The other speaker, besides Mr. Grew, was Julius H. Barnes, former president of the United States Chamber of Commerce. Mr. Barnes gave some interesting historical data concerning the growth of this country, showing the remarkable industrial progress being made in finance and trade. He painted a glowing picture of the future possibilities of foreign trade when he said:

AMERICA LEADS THE WORLD

"America has achieved a leadership in industry which has resulted in the highest earnings, the highest living standards, the highest individual aspirations, that the world has ever seen; that this has resulted in the great flow of articles of use from factory to home, indicated by the rising figures of railroad tonnage exceeding one million loaded railroad cars per week for many successive weeks. And from this demonstration of what adequate buying power has done in this 110 million people, only 6 per cent of the world population, it is interesting to wonder to what heights the tide of overseas commerce will rise when the other 1,600 million human beings in the world, fast or slow, learn to aspire to own; and by developing their own earning power begin to acquire the means to satisfy those aspirations. Fast or slow, these other peoples will follow the path which America has thus blazed in social progress and in the wake of their progress must flow the great streams of international trade in increasing volume."

In his summarization of the attitude taken by our government toward foreign trade, Mr. Grew said:

"Our government has from time to time been charged with economic or financial imperialism. Need I say that such a charge is baseless? No such policy could receive the approval or support of our government's agencies. Our government does not seek to exploit or extend control over other nations through the agency of foreign trade and the investments of American citizens in foreign countries. It will furnish and safeguard fair and equal opportunities for American enterprise and investment abroad, but it will not undertake to sponsor private interests or urge them to engage in special enterprises in designated countries. It will hold the door open, but it will not force or urge American interests to cross the portal."

W. W. Nichols of the Allis-Chalmers Manufacturing Co., president of the association, in his annual address, warned against the growth of what he said is ill-named a "favorable balance."

The ill-named "favorable balance" of trade which as long as our gold reserves remain at their present unprecedented levels is decidedly unfavorable to our best interest, Mr. Nichols said, has increased to over a billion dollars, an excess of 27 per cent of our enormous exports, whereas two years ago this excess had been reduced to less than 5 per cent.

Discussing problems of the Pacific Professor Jeremiah Jenks, president of the Alexander Hamilton Institute and research professor of government at New York University, warned against the surrender of the Philippines by the United States.

Mr. Nichols was re-elected president for the ensuing year. Vice-presidents elected are: Edward Prizer, the Vacuum Oil Co.; F. H. Taylor, S. S. White Dental Manufacturing Co.; Julius Goslin, Joubert & Goslin; W. W. Mitchell, the Pacific Sanitary Manufacturing Co.; H. B. Utely, the International Harvester Co.; and W. H. Robinson, H. T. Heinz Co. The treasurer is Louis C. Brady, of the Bankers Trust Co.

Automotive Engineers Seek Methods to Prevent Engine and Car Troubles

Hold annual service meeting with automobile executives

The thirteenth semi-annual service engineering meeting of the Society of Automotive Engineers and the National Automobile Chamber of Commerce was held at the LaSalle Hotel, Chicago, Ill., on Nov. 9 and 10. Several papers were presented, these being followed by discussions and interchange of service methods ideas based on practical experiences.

The outstanding topics of the meeting dealt with the prevention of engine and car troubles, whereas former sessions covered trouble cures. The facilities for issuing adequate service and correctly diagnosing car troubles also were discussed.

The opening address was made by O. B. Zimmerman, of the International Harvester Co. Mr. Zimmerman emphasized the importance of satisfactory maintenance facilities and pointed out the value connected with the issuing of proper automotive service for the protection of the car owner's investment.

A good attendance was on hand consisting of service engineers from various parts of the country, most of the important companies being represented.

Of the four sessions that were held, two were under the direction of the N. A. C. C., whereas the two others were arranged by the S. A. E. In the absence of Alvan MacAuley, A. B. Cumner of the Autocar Co., and F. J. Wells of the Pierce-Arrow Motor Car Co., acted as chairmen for the N. A. C. C. sessions. H. L. Horning, of the Waukesha Motor Co., and L. H. Pomeroy, of the Aluminum Co. of America, were the chairmen for the S. A. E. session.

The following papers were presented:

"Maintenance for the Protection of the Car Owner," by George Frank Lord, Durant Motors, Inc.

"Designing with Consideration for Repairmen's Tool Equipment," by D. C. Hinckley, the Hinckley, Myers Co.

"Corrosion in Internal Combustion Engines," by Frank Jardine, the Aluminum Co. of America.

"New Data on Engine Corrosion," by M. A. Thorne, the Tidewater Oil Co.

"Diagnosis of Automobile Chassis Troubles," by C. L. Sheppy, J. C. Talcott and Charles Pleuthner, the Pierce-Arrow Motor Car Co.

"Engine and Car Troubles, Their Diagnosis and Cure," by Carl Breer and John Squires, the Chrysler Motor Corporation.

"Automotive Fuel from the Service Standpoint," by T. A. Boyd, the General Motors Corporation.

"New Devices for Improving Car Operation," by Donald Blanchard, *Motor World Wholesale.*

Lack of Sound Credit Facilities Hampers Sales of Machine Tools to Germany

Exports dropped sharply since August first

There has recently been a very sharp change in the German demand for American machine tools, and although a few months ago our exports of such equipment were in large volume, this trade may not be sustained, says the industrial machinery division of the Department of Commerce. Demand for these tools in that market appears to be ample, but conditions in Germany cripple business and suggest that this trade will be seriously affected.

Collapsed During War

A brief review of past experience in this market will make the present situation clearer. On the average, during the five years 1909 to 1913, inclusive, Germany absorbed $2.280,000 worth of American metal-working machinery. In 1913 this volume was $3,175,000. During the war this trade collapsed, and following the armistice the volume was very small because of the import embargoes imposed by Germany. During the life of these embargoes, a certain small volume of business was possible if special import licenses were secured. The experience through 1923 was as follows: 1919, $8,746; 1920, $144,192; 1921, $118,393; 1922, $77,120; 1923, $209,474.

In the latter part of 1924 this embargo was lifted, with the result that the total business for that year was $545,315. For 1925 there was a very marked increase. Comparing only the first half of each year, while the shipments to Germany in the first six months of 1924 approximated $210,000, the volume during the corresponding period of 1925 was nearly $1.500,000. However, since about the first of August these sales have dropped sharply.

On taking this situation up with the Berlin office of the department by cable, Trade Commissioner Pilger replied that American machinery sales in Germany have dropped considerably since Aug. 1—a reflection of the prevailing bad business conditions. Many dealers are pessimistic. Customers are still willing to buy but are asking terms exceeding six months or one year, which are practically impossible. Many of these potential purchasers are in such a financial condition that they will probably have to undergo reorganization very shortly and, therefore, do not constitute good credit risks.

Money Is Lacking

The alternative is presented of doing business by taking a chance on long credits to questionable firms, or of curtailing the amount of business sharply. Customers have the desire to buy Amercian equipment but have not the necessary money. German machinery manufacturers have seen the new types of special machines which have met with a good market during the early months of 1925 and are rapidly bringing out copies that can be sold at a lower price, even though their effectiveness and reliability have not yet been demonstrated.

The volume of machinery sales is not expected to increase before next spring, as an earlier improvement in the general industrial situation is not probable for the following reasons: An excess number of business houses are operating ineffectively; artificial regulations of all sorts prevent the normal operation of natural economic laws; shortage of capital has resulted from the collapse of the old reichsmark, and the people as a whole have been living beyond their means. There also appears to be a gradual drying up of the ready sales of German securities to American investors.

In general, business does not depend so much upon the prices quoted as upon the terms offered, but the business had better be declined unless some arrangement can be made under which American manufacturers by group effort are continuously able to obtain credit information and keep in touch with local conditions to an extent which would justify the sale of equipment on credit or the handling of stocks on some safe consignment basis.

Restriction Is Necessary

Since the embargoes were lifted on Oct. 1 and the new German tariff came into operation, the German banks are restricting credit if it is to be used to cover import transactions. Probably from the German point of view this is a necessary policy, although it restricts American business. Nevertheless, it will probably be a necessary policy until the German balance of trade is turned and exports exceed imports.

Much of the machinery that has been imported has been for German manufacturers of automobiles, but these manufacturers are still uncertain as to their ability to compete against foreign cars, even though their product is protected by a high tariff, because the volume of their output is limited. Consequently, they are maintaining a careful watch over their costs and will continue to do so until they know definitely their actual position. Therefore, for the time being they are not buying new machinery.

Some of the rush of the American machinery business which developed during the past spring and summer was due to the fact that the dealers were stocking up; this stock has not yet been sold to manufacturers. Also, July and August are vacation months and little business can be done—a change that would be reflected in orders received in America during August and September. Finally, it is also true that September, October, and November are usually poor months for the sale of machinery to be used in the manufacture of automobiles, bicycles, motorcycles, etc., which will not be put on the market until the following March.

Unquestionably, the industries of Germany are in need of American machinery. In pre-war years they depended on this equipment to a very great degree, but it has not been readily available to them for nearly a decade. As Mr. Pilger states, German customers have the desire to buy but it remains to be seen whether business conditions will make this possible.

Truck Manufacturers Plan Standardization of Parts

The extent to which motor trucks may be standardized in the interests of more economical and more efficient transportation for the nation was the keynote of the meeting of Motor Truck Industries, Inc., which was held in Washington on Nov. 18 and 19. The meeting brought together motor truck makers, parts manufacturers, truck distributors and servicing agencies, and owners of fleets of motor trucks.

The membership of the truck group considers that the interests of 2,150,000 motor truck owners in the United States demands that action be taken to promote greater interchangeability of parts, to develop simplifications which will reduce costs of maintenance and will lessen to a minimum the time which is needed to keep trucks in active transportation work.

One of the chief proposals that came before the conference, was that of standardizing to four sizes the present variety of chassis capacities. It has been recommended that there shall be two sizes in the so-called "fast freight" type, 1-ton and 1½ to 2 ton; and two sizes for the heavy-duty class, 2½ to 3 ton and 4 to 5 tons.

The organization has had simplification and standardization committees at work for some months, and these have been working in close harmony with the Society of Automotive Engineers.

Committees that severed reports included: Motor and accessories; axle, wheels and springs; transmission, clutches, controls and transmission brakes; propellor shafts, joints and bearings; frames, cross members and brackets; bodies, cowls and seats; steering gears; sales and finance.

Lectures at Power Show

An excellent program of lectures will feature the forthcoming exposition of power and mechanical engineering to be held in the Grand Central Palace, New York, from Nov. 30 through Dec. 5. These lectures will cover the field of power and mechanical engineering and will be presented with a view to making public the latest information about new development in the various fields and interpreting the power show to visitors. Fourteen lectures will be given.

Other topics to be presented are refrigeration, mechanical power transmission, materials handling in the power plant, and materials handling in industry. The program of lectures will be amplified with a series of motion pictures collected from various governmental and industrial sources.

Business Executives to Study Plan for Elimination of Waste in Distribution

National Conference at Washington in December

A general plan for the self-regulation of business and the establishment of ethical and economic standards of business practice will be laid before the National Distribution Conference at its general meeting in Washington, Dec. 16 and 17, under the auspices of the Chamber of Commerce of the United States.

The plan is outlined in the report of the conference's committee on trade relations, of which A. Lincoln Filene, of Boston, is chairman, and the membership of which includes representatives of more than fifty trade associations and executive officers of important manufacturing, wholesaling and retailing corporations. Its primary objective is the elimination of wastes in distribution, but to accomplish this it proposes the building up of institutional machinery by business men for the regulation and stabilization of their own affairs with the ultimate object of reducing to a minimum the cost to the public of the products it consumes.

The essential features of the framework of the plan set up by the committee for consideration of the gathering of business men are: (1) A joint trade relations committee, constituting in effect a supreme court or clearing house of business.

(2) The further development and enforcement of trade standards within particular trades through the formulation of effective codes of practice.

(3) The further development of arbitration machinery within particular trades for the direct adjustment of disputes and the prevention of costly litigation.

The plan embodied in the recommendations of the committee is the logical development of tendencies already at work within trades. It is the application to business in general of the methods evolved by certain trade associations for the regulation of particular industries.

As indicating the variety of trade abuses the committee enumerates, cancellations and returns, overselling, delays in delivery, substitution, commercial bribery, unethical credit practices, attempts to evade contractual obligations, excessive demands for services, discrimination among customers, unethical relations to a competitor.

The elimination of trade abuses is not the most important result to be achieved, according to the report of the committee. "It is our conviction," it continues, "that the most wasteful trade practices that exist between producers and distributors are not those described here, costly though they may be. The greatest waste in our economic life lies in the fundamental lack of accord between production and distribution.

"This has probably come about through the separation of producers and distributors with the rapid growth and specialization of industry. The economic fact of interdependence of production and distribution has largely been lost sight of in the desire of manufacturers as a group, and retailers as a group, to advance their own interests even when these are seriously opposed to the interests of the group to whom they sell or from whom they buy."

Enumerating some of the wastes resulting from this lack of co-ordination between production and consumption the committee mentions:

(1) The manufacture and distribution of too many varieties of specific articles, both in staple and style merchandise.

(2) The manufacture of more goods to sell at a certain price than the consumption of merchandise at that price warrants.

(3) The present hand-to-mouth placing of orders by retailers with little regard to economy in the manufacturer's program.

(4) Failure by makers of similar articles to adopt standard sizes.

(5) Lack of standardization of quality and workmanship.

(6) Unsound extension of credit by manufacturers to wholesalers and retailers.

(7) Discounts in terms of payment which represent an obviously uneconomic concession to the purchaser.

(8) Wastes due to damaged containers.

(9) Failure of producers and distributors to determine scientifically and co-operatively under what circumstances each should bear the risks of merchandise before it is finally sold to the public.

(10) Highly speculative buying and selling which has resulted from the practice of copying merchandise.

Progress Made in Study of Temperatures

An all day session of the joint committees charged with the research into the effect of temperature on the properties of metals was held on Oct. 25 at Cleveland. This work, sponsored by the American Society of Mechanical Engineers and the American Society for Testing Materials, has progressed to the point where manufacturers are eager to co-operate and several have offered to supply materials for the tests.

A report was presented by the subcommittee on specifications for high temperature tests. This sub-committee, headed by L. W. Spring, submitted revised forms of specifications for short and long time tests, which had been discussed at the preceding meeting. These specifications, as adopted, are now in proper form to be released to the co-operating laboratories. They are accompanied by the sample log sheets and stress-strain diagram sheets, for the guidance of all co-operators, so that reports will be uniform and can be compared directly as received.

The sub-committee on co-operating laboratories, headed by C. T. Malcolm, reported that practically all the laboratories addressed expressed a desire to co-operate in these investigations to the limit of their facilities and personnel.

The present set of tests is for the determination of the tensile properties of these metals under elevated temperatures. The committee discussed plans contemplating contemporary work on other physical properties of metals at high temperature such as fatigue phenomena, corrosion, erosion, etc. This work will be allotted to other co-operating laboratories than those working on the present group of tests.

The plans were formulated for a survey to obtain reports from users of metals concerning their experiences in finding suitable materials for use under severe service conditions involving abnormal temperatures, either above or below normal.

American Motorcycles Favored Abroad

The importance of foreign trade to the American motorcycle industry is shown in the fact that this country during the five years, 1920 to 1924 inclusive, produced a total of 196,885 motorcycles, of which 103,570 or about 53 per cent were exported says the automotive division of the Department of Commerce. The demand abroad for American motorcycles is increasing. Exports for 1924 totaled 16,859, compared with 16,339 during the first nine months of 1925, and it is anticipated that the total for 1925 will be approximately 22,000.

Foundrymen Meet

The 349th dinner and meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Nov. 11. The meeting was preceded by a dinner at which most of the members attended.

The subject for discussion at the meeting was "Cutting Down Waste on Castings." The speakers were Alan A. Wood, sales engineer, and John Smith, foundry superintendent, both from the Builders Iron Foundry Diamond Machine Co., of Providence, R. I. The discussion was accompanied by lantern slides and an effort was made to show how to reduce the cost of both the metal and the time in making castings true to pattern in iron, steel or brass of any size.

To Close Army Shops

The Army's motor transport plants are to be closed down. By June 30, 1926, Camp Holabird, Md., Camp Normoyle, Tex., and the motor repair section of the San Francisco depot will cease operating. Minor repairs to Army motor vehicles will be made locally by posts and depots, and major repairs, which cannot be handled by post shops, but which are justified by the condition of the vehicles, will be made by commercial concerns.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE wild advance in the stock market received a severe check last week. After the close of business on Monday, the Federal Reserve Bank of Boston announced an advance of one-half per cent in its rediscount rate, which formerly stood at 3½ per cent. The next morning at the opening of the New York Stock Exchange there was a stampede to liquidate. Some of the over-exploited speculative favorites fell as much as 26 points, and even such a staid stock as United States Steel common sold at 11 points below the high of the previous week.

The day was a wild one, nearly 3,500,000 shares changed hands, the greatest day's trading in the history of the exchange, and the excitement did not fully subside until Wednesday evening. All day Thursday the market was in a state of suspense lest the New York Federal Reserve Bank should follow the example set it by the Boston bank and raise its rate.

But on Friday morning, when it became known that the New York Federal Reserve Bank had not advanced its rate, the trading became more orderly. It seems unlikely, however, that speculators will soon again become as reckless as they were before the Boston bank acted.

The advance in its rate ordered by that institution is perhaps due to the increased demand for money in New England, but, on the stock exchange it has been accepted as notice that the Federal Reserve authorities intend to use their power to protect the supply of credit under their control. It is realized that an increase in the rediscount rate of the New York bank would work a marked change in the psychology of the stock market.

But the advance in the Boston rate has had a somewhat different effect on the minds of merchants and manufacturers, who had come to fear that the continued advance in the stock market was a menace to general business. Now they feel confident of being able to get the money that will be required to finance the impending improvement in trade, and they are going ahead with more agressiveness than they have shown for some time. Less and less is heard of hand-to-mouth buying and larger orders at current prices are reported in many lines.

The markets where agricultural commodities are speculatively dealt in were almost unaffected by the collapse on the stock exchange.

Although cotton dropped a cent a pound on Monday's government crop estimate, which raised the total yield to 15,386,000 bales, the decline was recovered with a promptitude that amazed.

What's Doing in Industry

With November more than half over, speculation as to whether machine tool sales will continue becomes more interesting. Sales and new inquiries in the early part of the month indicated that October records would be equalled, and the trend up to the present writing seems to bear out this prediction.

General manufacturing sources furnish the greater part of current orders. The replacing of obsolete and worn-out machines has been forced on many manufacturers by the keenness of competition today, and just so long as business continues active will such replacements be necessary.

The Mid-West holds the center of the stage. Chicago reports November ahead of October, with orders increasing. Detroit sales are keeping apace with the expansion in automotive industries. In Cincinnati the trend is upward, with orders well scattered among all classes of buyers. Cleveland also reports better conditions.

Industrial expansions in Canada are progressing, bringing increased demand for machinery of all kinds. New England continues to improve, with better working schedules prevailing. New York reports a better demand for extra equipment for machines already in use. Buffalo is experiencing the most prosperous condition in the past few years.

An optimism that is almost nationally inclusive prevails and its pervasiveness is the only discernable reason for being cautious.

The levitation of the sugar market has also been a surprise to the bears in that article. The drought in Cuba, the damage done by the frost to the sugar beets in the West, and the threatened refusal of the Cuban colonas to cut their cane unless they are given a larger percentage of the sugar derived from it are at last commencing to have an effect.

Wheat continues to present an anomaly. Foreign crop advices are almost uniformly favorable but the tightness of the domestic situation in the United States holds prices firm. An increasing amount of Canadian wheat is reported as coming in over the tariff wall.

Most of the other commodities are steady to firm. Increased activity is reported in the steel industry at slightly higher prices. The unfilled orders of the United States Steel Corporation gained 391,886 tons in October to a total of 4,109,183 tons. This was nearly twice the gain of the preceding month, which showed an improvement of 204,494 tons.

Rubber is again above the dollar mark and some fear is being expressed that we may run into another position of acute stringency such as we had early in the fall.

There is no let-up in new construction, and an unusual amount of winter building is indicated.

An optimism that is almost nationally inclusive prevails and its pervasiveness is the only discernible reason for being cautious.

From Great Britain, an increased cheerfulness is also reported, and some improvement in trade seems to be apparent now that the embargo on foreign loans has been removed.

Satisfaction is expressed on both sides of the Atlantic over the Italian war debt agreement which was arrived at the week before last in Washington. Under the terms agreed upon by the commissioners of the two nations, Italy will pay to the United States a total of $2,407,000,000 over a period of sixty-two years. The initial annual payment will be $5,000,000 which will rise gradually to a maximum of $80,000,000 during the last seven years of the period. It is expected that Italy will float a large loan in the American market to stabilize her currency.

The financial vacillation of the French government continues to provoke doubt as to the ultimate fate of the franc. Just what the outcome will be is uncertain, but a lottery loan is the latest expedient proposed to avert temporarily the inevitable.

The weekly statement of the Federal Reserve banks shows a reserve ratio of 72.3 per cent as against 71.5 per cent a week ago. Total reserves have gained $10,000,000, and total bills discounted show a decline of $72,000,000.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Indianapolis

A volume of business that is quite satisfactory is featuring the trade in this territory. October was a good month and the first two weeks of November also were good, leading the trade to believe that the last weeks of the year will show up much better than the same period last year. Many leaders in the trade are casting their eyes ahead to next year in an effort to determine what it promises. The outlook is good, they say.

A demand for machinery is coming now from the coal fields. Most mining companies in this state have built up small surpluses since the mines reopened early in the fall and are making some much needed replacements.

Some demand continues to come from the automobile trade. A market is developing for drills, screw machines and lathes. Furniture factories continue to make inquiries. Demand for special machinery from these plants has been good. Railroad buying appears to have slumped, but it is believed this is only temporary. Several inquiries have been received concerning cranes and other yard equipment.

Cleveland

Reports obtained from dealers and manufacturers of machinery and machine tools as to business conditions show a variance in opinions. Automatic machinery producers and lathe builders state that business is "very good," while dealers in planers, punches, shears and other lines claim business as rather "quiet."

They all agree, however, that their sales for the month of October, averaged 5 to 20 per cent greater than the corresponding month last year. Metal working and industrialists were the chief buyers.

Inquires are plentiful; this combined with new appropriations, which are being made up at the present time will have a tendency to stimulate business for the next two months.

Detroit

Sales of machinery and machine tools in the Detroit district are keeping pace with automobile production, which is the highest ever for this season of the year.

Several manufacturers are easing off in production preparatory to the annual inventories scheduled for next month, but others have definitely announced that on account of heavy sales the inventory period this year will be eliminated.

The Ford Motor Co. continues to be the heaviest buyer of equipment. As forecast in these columns some weeks ago Ford is gradually bringing production up to the high water mark of all time. For several consecutive weeks new daily production figures have been made. Ford has been partially machined up for a daily capacity of 10,000 for two years, but the actual cars made have fallen far short of this figure, owing to the inability of the sales department to sell all the cars that it was possible to make. The new models have proven so popular that a daily production mark of more than 9,000 has now been reached. Engineers are busy at present ordering the remainder of such machinery and equipment as are necessary in the manufacture of 10,000 cars daily.

The three million dollar plant of the Hudson Motor Car Co. being erected on the site of the old Clayton & Lambert Stamping Co.'s plant is nearing completion. This plant, with machinery to be installed, will be devoted exclusively to the manufacture of Hudson and Essex coaches.

The Continental Motors Corp. is showing greater activity in both its Detroit and Muskegon plants than for some time. Several sizable orders for machinery have been placed recently for these two units.

New York

Business in the local market continues at an even rate, the most important feature being new orders and inquiries from unexpected sources.

November figures will probably not reach the total set in October, although the volume of orders so far is quite satisfactory. Small tools and accessories are in better demand now than in some time. This is especially true of attachments and extra equipment for machine tools. Most of the buying is being done by industrialists, demand from railroads and automotive sources having fallen off in the past ten days.

The majority of orders are for single pieces that are to replace obsolete or worn out equipment. The A. O. Smith Corporation, which has been an active buyer for the past month, placed an order here last week for 20 dry grinders. The Hannum Manufacturing Co. bought 6 worm grinders. The American La France company bought a 16-in. lathe and a 16-in. thread milling machine. Other orders from various sources included engine lathes, presses, heavy-duty cranes and yard equipment.

Canada

The machinery and machine tool businesses in Canada are benefiting to a considerable extent from the general industrial expansion. The major industries of the country have become more active during the last couple of weeks. The iron and steel mills are again operating closer to capacity. More than 60,000 tons of rail business has been placed, and the demand from automobile and agricultural implement companies has increased.

The British Empire Steel Corporation has received an order from the Canadian National Railways for 53,213 tons of rails, tie-plates, angle bars, spikes and track bolts. It is also announced that a large order for the Canadian Pacific Railway is just being completed.

New England

The machinery industry in the New England territory continues to improve and is in the condition now where overtime operations and increases in working forces are necessary to meet production requirements. It is probable that prices may be advanced.

A summarization of reports of several industries reporting business improvement indicates that the trade is operating about 5 per cent overtime. Some of the reports show plants with schedules increased as much as 10 per cent. And reports on increased working forces, where they have been added to, show 22 per cent improvement.

Buying in the machinery industry is general, with preponderance favoring the automotive trade. Inquiries have also increased. The consensus of opinion of sales managers is that trade will continue good until spring, at least.

Cincinnati

The feature of the market in the past week, according to Cincinnati manufacturers of machine tools, has been a generally improved tone. The trend continues to be gradually upward.

A gratifying feature pointed out is the absence of spottiness in the demand. Orders booked and inquiries received are well distributed geographically and in respect to sizes and types of tools. While the greater part of the buying has been for replacement, an increased amount of the purchases have been for expansion.

Selling agencies report that there is now an increased amount of business in sight, and they are expecting their bookings to increase. More lists of requirements are coming in, they state, and orders are following inquiries more promptly.

Buffalo

Complete reports on October and activity for the early part of November indicate that the Buffalo machine tool trade is more prosperous at this time than has been the case at any period in 1925; and probably more prosperous than at any time in 1924.

In almost every case final figures on October showed up better than the same month last year. Some reported the first part of November to be a trifle slow but there seems to be a disposition to believe that the month at the end will show up better than October and the belief seems to be general that December will also be good.

The announcement that the Donner Steel Co., of Buffalo, is to erect additional units is supplemented by reports in the field that contracts for about $75,000 worth of equipment have been awarded, mostly among Buffalo dealers.

Chicago

Continued factory production in the Middle-West on an increasing scale is reflected in local machine tool business. Every branch and department of the machinery industry is benefiting by unusual manufacturing activity throughout this section of the country. Many industrial plants are adding to their equipment to take care of present and prospective orders.

In the production of gears and gear cutting machinery, Chicago's largest plant of this kind reports a demand almost unprecedented, with the added information that business thus far in 1925 is the biggest in its history.

Metal-working machine tools are in good demand, with the indication that the month of November will prove to be better than October so far as sales go.

The Bethlehem Steel Co., of Bethlehem, Pa., placed an order last week with Joseph T. Ryerson & Son, Inc., of Chicago, for 124 Ryerson-Glader steel frame nail machines and 16 Ryerson-Glader barbed wire machines. This equipment is intended for the Bethlehem company's new plant at Sparrow Point, Maryland.

News of the Automotive Industry

Official figures show that the Brazilian market for American automobiles has been making remarkable progress. Almost twice as many cars entered through the port of Santos in 1924 as in 1923. The total shipments in 1924 reached 21,774.

Imports of American automobiles into the Argentine are expected to reach at least sixty-thousand this year. American cars made up 97 per cent of the total cars taken into that country this year.

There has been no change in the taxation situation in Ireland and until something is done it is not expected that automotive business in that country will make any headway. It is hoped that when Parliament meets this month a commission will be appointed to investigate the transportation problem and arrange some efficient and agreeable means of solving the difficulty.

The annual Olympia automobile show in London, now in progress, lists sixty-one exhibitors. Americans represented include Chevrolet, Chrysler, Dodge, General Motors, Graham, Overland and Reo.

Exports of all automotive products from the United States and Canada during September were valued at $30,245,434 as compared with total exports during August valued at $31,243,310, according to the automotive division of the Department of Commerce. These value figures indicate that while there was a considerable decrease in actual vehicle exports, the trade as a whole has not suffered to any great extent. The exports of assembly parts increased over one million dollars in value; this feature of September's export trade is particularly significant when an explanation of the current trend is attempted.

Bankers in Detroit who have been connected with recent motor merger negotiations declare that developments of magnitude are in the making and that evidence of what is going on secretly will be available before long, regardless of denials.

Those interested in the negotiations believe that the time is not far off when several of the larger producers must consolidate to meet General Motors and Ford competition. The ideal set-up would be the inclusion of a volume four-cylinder company with producers of sixes and eights.

Large stockholders in several prominent companies have been approached with flattering offers for their holdings.

The outlook for 1926 is for a year of most severe competition and bankers believe producers are more likely to lend a kindly ear to merger talk which will bring into the family the needed merchandise and plant facilities and cut down overhead and other costs, than they are to expand on their own accounts.

The Buick Motor Co. has appropriated $2,000,000 for additions to its plant, purchase of machinery, tools, etc., in order to increase production to 1,200 cars per day.

Buick's new line of cars introduced in August is meeting with satisfactory demand and the company has found it impossible to keep pace with orders, and therefore is increasing plant capacity.

In October, usually a month when production begins to fall off, Buick shipped 23,000 automobiles, breaking all monthly production records.

The A. C. Spark Plug Co. will start production of automobile mufflers in Flint this week. The company recently acquired patent rights for the manufacture of Gray-Hawley mufflers, heaters and sundry automotive accessories. Equipment for turning out several thousand mufflers a day has been installed and will be increased as demand necessitates.

The Hupp Motor Car Corporation produced 2,779 eight-cylinder cars in October. This compares with September output of 1,397 cars, of which the greater part were "eights," and with 1,537 cars in October last year, when output consisted solely of four-cylinder cars.

The General Motors Corporation in October broke all previous records in earnings and sales for the second consecutive month this year. It is estimated that sales to dealers by the corporation's divisions, Buick, Chevrolet, Cadillac, Oakland and Oldsmobile, were close to 96,000 cars and trucks.

October set a sales record for the Reo Motor Car Co. in all lines. More cars were delivered than in any previous October, while truck sales were 30 per cent ahead of the best previous October. Greater prosperity of the farmer is indicated in the increase in orders from rural communities.

Increasing demand for the heavy-duty speed wagon has forced the transfer of the assembly line for this unit from the bus plant to the main factory, making also possible a greater production of buses.

The reduced treaty rates on Italian automobiles imported into Germany provided by the commercial treaty recently signed between Italy and Germany are, for automobiles weighing from 500 to 900 kilos, 175 reichemarks, and for automobiles weighing 900 to 1,200 kilos, 180 reichmarks per 100 kilos. These reduced rates will probably become effective on Dec. 15, and will also apply to automobiles of similar weight from the United States and other countries receiving most-favored nation treatment from Germany, including Belgium and the United Kingdom, but not including Canada or France.

What the Railroads Are Doing

As a further step to bring about increased economy in railroad operation, the American Railway Association has approved the use of a 39-ft. rail in place of present 33-ft. rail. This increase in length means a reduction of 16 per cent in number of rail joints and amount of necessary bolts, nuts, etc. It is estimated that fifty cents of each dollar spent for track maintenance goes for maintenance of joints, ties and ballast under point where rails are joined, and surveys show that greatest wear and deterioration in rail occur at the joining point, so that a reduction in the number of these connections will result in a saving in wear and tear on railway equipment.

The Pennsylvania Railroad Co. will spend $50,000,000 in 1926, of which $15,000,000 will be paid for improvements in Pittsburgh alone, Gen. W. W. Atterbury, president, announced recently.

"There was a time in Pittsburgh," he said, "when millions of dollars were tied up in coal, steel products and other materials, because of delays in the movement of them, but that no longer exists. Through improvements made these are not held even hours; thus the railroad is performing a great service for the manufacturer. The outlook for 1926 is exceedingly bright and from all indications good business will be enjoyed."

The Baldwin Locomotive Works has received an order for 10 Santa Fe type engines from the Missouri Pacific Co., and has also booked 8 engines from Brazil and 3 from Japan. Operations at the plant have been built up to about 35 per cent.

The New York Central R.R. has ordered 1,500 freight cars from the American Car and Foundry Co. About $3,000,000 is involved.

The company has also purchased 1,000 gondolas from the Pullman Car and Manufacturing Co., 1,000 from the General American Car Co., 500 from the Standard Tank Car Co. and has booked 500 box cars with an unannounced maker. These orders involve close to $6,000,000.

The New York, New Haven & Hartford has ordered ten heavy locomotives from the American Locomotive Co. The General Railway Signal Co., has received an order to furnish complete train control equipment on 100 locomotives recently ordered by the New York Central from the American company and on 25 locomotives booked with the Lima Locomotive Works.

As a result of the excellent performances made by the four locomotives recently purchased in the United States by the South African Railways and Harbors Administration, a further order for 15 engines has just been placed with the same American firm. The American manufacturers were able to underquote the British competitors and to undertake much more prompt delivery than either the German or British firms.

The decisive factor, however, was the sensational performance of the American engines. One American locomotive brought the mail train through from Johannesburg to Cape Town a distance of 956 miles on schedule time. The superiority of the American locomotives seems to be partly in size, but more particularly in the hard grease lubrication, self-cleaning smoke boxes, and perfected valves. The superior method of construction by the use of rigid forms also appears to have produced a more satisfactory general structure.

Personals

WILLIAM M. JAMES, formerly superintendnet of the Walker Vehicle Co., of Chicago, has become works manager for the Kearney & Trecker Corporation, of Milwaukee.

H. T. CHANDLER has been appointed assistant to the president of the Vanadium Corporation of America.

R. F. MANN has been appointed purchasing agent for the Warner & Swasey Co., of Cleveland.

JOHN H. WALSH, recently appointed member of the U. S. Shipping Board, was formerly president of the American Society of Naval Architects and Marine Engineers, and is well known in engineering circles.

J. M. PRICE has been elected president of the Electro Metallurgical Sales Corporation, of New York.

G. F. PRESTON has become associated with Louis Henes, representative of the Milwaukee Electric Crane Co., and manufacturers of machine tools, in the San Francisco Territory.

W. B. WACHLER has been appointed assistant to the president of the General Motors Export Co. and is located in the company's New York office. He was formerly connected with the Hyatt Roller Bearing Co., at Newark, N. J.

J. E. FINNERAN has become associated as a member of the firm of the Columbus Anvil and Forging Co., of Columbus, Ohio. He was connected with the Buckeye Steel Castings Co. for twenty-two years.

GEORGE G. GRIEST has resigned as general manager of the Hamilton, Ohio, plant of the Niles Tool Works Co.

J. A. CAMM has resigned as sales manager of the W. F. & John Barnes Co., of Rockford, Ill.

H. T. HERR, resident vice-president of the Westinghouse Electric and Manufacturing Co., in charge of the South Philadelphia works, has been appointed general manager of the main Philadelphia plants and also of the Stoker works at Attica, N. Y. Mr. Herr will also direct the sales work.

CARL B. HINSMAN has resigned as president of the Howe Scale Co., of Rutland, Vt., and Frank G. Riehl, of Jamestown, N. Y., was elected to fill the vacancy.

JAMES COLEMAN, general superintendent of car equipment for the central region, Canadian National Railways, has retired after 52 years of service.

J. W. WIDDUP, of Brantford, Ontario, has been elected a director of the Russell Motor Car Co. of Canada, Ltd.

Obituaries

JOHN T. ROWE, manufacturer of mathematical instruments, died recently at his home in Montreal, Canada, in his 64th year. In his early years Mr. Rowe was actively engaged in the foundry and machine business, having been for more than 20 years foreman of the machine business of E. Chanteloupe, in Montreal

GEORGE FRYE, superintendent of the machine shop of the Vonnegut Machinery Co., of Indianapolis, was killed on Nov. 10 by electricity while testing a new machine. He touched a cable carrying a heavy current.

HERBERT BATES, managing director of Hulse & Co., Ltd., Ordsal Works, Salford, England, manufacturers of heavy machine tools, died on Oct. 17. He was a former president of the Manchester Association of Engineers.

ROY C. GREENFIELD, mechanical engineer with the Allis-Chalmers Manufacturing Co., of Milwaukee, died on Oct. 28 after a long illness.

CHARLES H. HERMAN, treasurer of the Elevator Supplies Co., of Hoboken, N. J., died on Nov. 1 at his home in Maplewood, N. J.

ALBERT J. EARLING, former president of the Chicago, Milwaukee & St. Paul R.R. died in Milwaukee on Nov. 10.

Business Items

The Norton Co., of Worcester, Mass., announces the opening of a Pittsburgh office at 338 Third Ave. A full stock of Norton grinding wheels will be carried in stock. Ralph O. Anderson continues in charge as district manager.

The Miles Machinery Co., which recently moved into a new plant, asks us to state that the new address is 900 S. Niagara St., Saginaw, West Side, Mich., which is an entirely different post office from Saginaw.

The Hubbard Steel Foundry Co. announces the completion of a new and modernly equipped machine shop at East Chicago, Ind. James Thomson is chief engineer.

The business heretofore conducted by the Sloan & Chase Manufacturing Co., Ltd., Newark, N. J., is now known as Sloan & Chase, Inc., and is located at the same address. The new officers are John V. Rice, Jr., president; W. McK. Morris, treasurer; William F. Smith, vice-president and general manager. C. S. Pratt is sales and advertising manager.

The Strong, Carlisle & Hammond Co., of Cleveland, has been appointed sole distrbutor in that territory for the complete line of lathe, drill and planer chucks manufactured by the Union Manufacturing Co., of New Britain, Conn.

At the last meeting of the board of directors of the Linde Air Products Co., G. W. Mead, former president, was elected chairman of the board. W. F. Barrett, formerly vice-president, was elected to the presidency. In addition to these changes R. R. Browning was elected vice-president in charge of sales, and J. A. Rafferty, vice-president in charge of engineering, manufacturing and research.

The Yale & Towne Manufacturing Co., Stamford, Conn., has acquired the Miller Locks Co., of Philadelphia, and the plant is to be operated as the Miller Locks Works of the Yale & Towne company. Arthur C. Jackson has been appointed manager of the Philadelphia plant, and E. C. Waldvogal, vice-president of Yale & Towne, will be in charge of sales.

P. M. Brotherhood, 25 Church St., New York, announces the opening of a Buffalo office. P. M. Brotherhood, Jr., who was manager of Manning, Maxwell & Moore's Buffalo office, is in charge of this Branch.

The plant of the Emerson-Brantingham Co., Columbus, Ind., has been sold at public auction to C. Russell Feldman of New York City for $115,000. The plant manufactured farm implements and machinery. The plant was purchased by the implement concern from the Reeves Pulley Co., in 1913. Mr. Feldman will sell the machinery and equipment in the buildings. The implement company has arranged for leasing one part of the factory where service will be given on products formerly manufactured by the company.

The Oil Jack Co., Inc., of New York announces the appointment of Fred D. Sweet as manager of the Mid-Western territory, with offices in the Wrigley Building, Chicago. Mr. Sweet was formerly manager of the U. S. Rubber Co., in the handling of automotive equipment, and sales supervisor of the Biflex Products Corporation, and secretary and general sales manager of the Steel Products Corporation.

The Perrigo Foundry and Machine Co., Beloit, Wis., has changed its corporate title to the Progressive Manufacturing Co. John Halvorsrud is president, and W. S. Perrigo, secretary.

The machine shop and foundry of the Ballard Drop Forge Co., in Seattle, Wash., was destroyed by fire on Oct. 27. The entire building was burned, together with the machinery and shop equipment worth several thousand dollars.

At a recent meeting of the board of directors of the Prest-O-Lite Co., Inc., M. J. Carney, former president, was elected chairman of the board. William F. Barrett, formerly vice-president, was elected to the presidency. Ralph R. Browning was elected vice-president in charge of acetylene sales activities. R. J. Hoffman was re-elected vice-president in charge of the storage battery and automotive divisions.

The Cleveland Automatic Machine Co., announces the opening of a New York city office in the Singer Annex Bldg. A. W. Schafer is the district sales manager.

Henry Disston & Sons, Inc., of Philadelphia, manufacturer of saws, files and tools, announces that its Australian branch has moved to larger quarters in a new two-story factory and sales office building at Camperdown, Sydney, N. S. W. In line with the policy of maintaining complete factory and service organizations this branch is provided with complete equipment for manufacturing saws and knives from steel furnished from the Disston works in Philadelphia, and for all kinds of repair work.

The Driver-Harris Co., of Harrison, N. J., has purchased the works and properties of the Electrical Alloy Co., at Morristown, N. J. The Morristown plant will be operated as the Electrical Alloy Division of the Driver-Harris Co. and the main executive offices and sales department will be concentrated at Harrison. A larger research and development department will be maintained and the Driver-Harris Co. feels that by this larger department it will be able to render a greater service to the electric heating and allied industries.

The Power Equipment Co., 315 Third Ave. North, Minneapolis, is now representing the Foote Bros. Gear and Machine Co., of Chicago, on industrial gears, spur, worm and herringbone speed reducers.

Pamphlets Received

An Investigation of the Efficiency and Durability of Spur Gears. By C. W. Ham and J. W. Huckert. Bulletin No. 149 of the Engineering Experimental Station, University of Illinois. Published by the University. The bulletin gives the results of an investigation of the efficiency of spur gearing and also data on the change and rate of change in the profiles of spur gear teeth subjected to wear.

List of References on Vocational Guidance. Library Leaflet No. 32 of the Board of Education, Department of the Interior, Washington, D. C. Prepared in the library Division. Price 5c. This 10-page leaflet is a bibliography of articles listed from periodicals which have appeared since 1916 and of books since 1913, on the subject of vocational guidance.

Trade Catalogs

Air Tools. Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y. A large sheet has been prepared with illustrations of many products of this company, which is entitled "Tools Best Adapted for Railroad Use." A table lists the specifications of each size and model in the line of equipment.

Balancing Machines. The Gisholt Machine Co., Madison, Wis., has published a bulletin describing the precision balancing machines of the universal and wheel types. Particulars are given as to the details of construction and principles of operation as well as many views of installations.

Bearings, Ball. New Departure Manufacturing Co., Bristol, Conn. A circular describes the benefits to be expected from the use of ball bearings in motors, and gives comparative cost figures between ball bearing motors and non-ball bearing motors.

Bearings, Roller. The Hyatt Roller Bearing Co., Newark, N. J. has published Dimensions and Load Bulletin No. 1559 on Hyatt roller bearings for industrial equipment. The bulletin gives the formulas and methods for determining safe bearing loads and many tables for use in determining the factors of load limit. The material contained is very useful and compactly compiled for easy reference.

Gear Shapers. The Fellows Gear Shaper Co., Springfield, Vt. "A New Development in Gear Cutting" is a forty-page, 6x9-in. detailed description of the High-Speed No. 7 gear shaper. The construction of the machine is completely described and directions for operation of the shaper are given in detail. Many illustrations are used to facilitate an understanding of the gear shaper methods of generation.

Materials Handling Equipment. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Motor Application. Circular 7378, 8½x11 in., is a thirty-two page description of the various types of Westinghouse materials handling equipment, including hoists, conveyors, trucks, locomotives, coal-handling equipment, dredges and tramways. The types of motors and operating equipment are also described. The views shown in the bulletin are interesting and well chosen.

Micarta. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is distributing a folder containing a sample disk of micarta punched and notched in many shapes to demonstrate the ability of the material to resist breaking off or chipping under the punching operations.

A list of uses to which micarta can be put is also included.

Motors. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin 1132 is a circular briefly pointing out the features of construction of the line of roller bearing motors manufactured by this company.

Reels and Spools. Mossberg Pressed Steel Corporation, Attleboro, Mass. Catalog No. 102 is a description of Mossberg pressed-steel reels, spools and appliances for the wire industry. A page with illustrations and specifications as well as a brief description is devoted to each model.

Steel Products. Moltrup Steel Products Co., Beaver Falls, Pa. Catalog No. 2 is devoted to a description and listing of the stock of this company, including various shapes of cold-drawn steel, turned and polished steel, machine keys, machine racks and flattened steel plates. The catalog, in its ninety-eight, 5x7½-in. pages contains many photographs, drawings and tables important in this line.

The composition of the catalog is excellent and the arrangement convenient.

Calendar of Local Meetings

American Society of Mechanical Engineers

San Francisco Chapter. Nov. 23. "Cost Accounting in the Printing Trades."

Detroit Chapter. Nov. 28. "Methods of Taking Inventories."

Society of Automotive Engineers

Washington, D. C. Nov. 20. "Ordnance Automotive Equipment," Cosmos Club.

Chicago. Nov. 20. Sectional meeting, C. F. Kettering, speaker.

San Francisco. Nov. 24. Northern California sectional meeting, "Mechanical Traffic Control," Engineers Club.

American Society for Steel Treating

Buffalo. Jan. 21 and 22. Winter sectional meeting, Hotel Statler.

Hartford. June. Spring sectional meeting.

Forthcoming Meetings

National Founders' Association. Annual Convention, Hotel Astor, New York, Nov. 18 and 19. J. M. Taylor, executive secretary, 29 So. La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., 29 West 39th St., New York City, Nov. 30, to Dec. 4. Calvin Rice, secretary, Engineering Societies Bldg., New York.

National Exposition of Power and Mechanical Engineering. Fourth annual event, Grand Central Palace, New York City, Nov. 30 to Dec. 5. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

American Association for the Advancement of Science. Annual meeting, Kansas City, Mo., Dec. 28, 1925, to Jan. 2, 1926. Barton E. Livingston, secretary, Smithsonian Institute Bldg., Washington, D. C.

American Society for Steel Treating. Winter sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron market remains firm at present levels, with little tendency toward further advance. Furnace coke is $1.25 and foundry, $2.25 per ton below the Nov. 6 level. The steel market is particularly firm in tin plates, galvanized sheets, wire products, standard rails, steel pipe, and the principal hot-rolled products. In the last mentioned class, mill quotations are $2@$2.10 per 100 lb., f.o.b. Pittsburgh, for bars; $1.90@$2 for shapes; and $1.60@$2 for plates. This represents a rise of about 10c. per 100 lb. in the maximum on bars and plates, during the past week.

Non-Ferrous Materials—Tin is 2c. and copper, ½c. per lb. above the Nov. 6 level. Lead and zinc remain unchanged. Fabricated brass and copper are higher, following recent advance in non-ferrous metals. Linseed oil is down Cleveland.

(All prices as of Nov. 13)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	4.90@5.00
Cincinnati	5.00@5.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.15	3.50
No. 12	2.35@2.45	3.94	3.20	3.55
No. 14	2.40@2.50	3.99	3.25	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.05	4.15	3.75	3.80
Nos. 22 to 24	3.00@3.10	4.20	3.80	3.85
Nos. 25 and 26	3.05@3.15	4.25	3.85	3.90
No. 28	3.15@3.25	4.35	3.95	4.00
Galvanized				
Nos. 10 and 11	3.40@3.50	4.35	4.25	4.00
Nos. 12 to 14	3.50@3.60	4.45	4.35	4.10
No. 16	3.65@3.75	4.60	4.50	....
Nos. 17 to 21	3.80@3.90	4.75	4.65	4.40
Nos. 22 to 24	3.95@4.05	4.90	4.70	4.55
No. 26	4.10@4.20	5.05	4.95	4.70
No. 28	4.40@4.50	5.35	5.10	5.00

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.15	50%	⅞	$0.18	35%
¼	.16	45%	1	.19	31%
½	.17	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.30 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	....	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	....	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	....	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York. 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.75
Tin, 5-ton lots, New York			66.00
Lead (up to carlots) E. St. Louis	9.87½	New York	10.75
Zinc (up to carlots) E. St. Louis	8.70	New York	9.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	21.00	20.75	20.00
Copper sheets, base	23.25	23.25	23.00
Copper wire, base	20.37½	17.25	17@17¼
Copper bars, base	22.37½	21.75	22@22½
Copper tubing, base	25.25	25.75	25.00
Brass sheets, base	19.62½	19.62½	19.37½
Brass tubing, base	24.25	24.00	19.87
Brass rods, base	17.37½	17.37½	17.12½
Brass wire, base	20.12½	20.12½	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28@29	28.00	28 03
Zinc sheets (casks)	11.75	12.60@12.95	12 27
Solder (½ and ½), (case lots)	40.00	41.00	38@42
Babbitt metal (83% tin)	60.00	.....	58@63
Babbitt metal (35% tin)	28.00	.....	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.75@13.00	12.00	12.00@12.50
Copper, heavy, and wire	12.00@12.50	11.37½	11.50@12.00
Copper, light, and bottoms	10.25@10.50	9.75	10.34@10.50
Heavy lead	8.25@ 8.75	8.00	8.50@ 8.75
Tea lead	7.50@ 7.75	7.50	7.50@ 7.75
Brass, heavy, yellow	7.50@ 8.00	7.50	8.75@ 9.25
Brass, heavy, red	12.25@12.50	9.75	9.00@ 9.50
Brass, light	6.25@ 6.50	....	7.75@ 8.00
No. 1 yellow rod turnings	8.50@ 9.00	8.25	7.50@ 8.00
Zinc	5.00@ 5.50	4.75	5.25@ 5.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@ .15½	.18	.17
Wiping cloths, washed white, per lb	.17¼	36.00 per M	.15½
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.02	1.13	1.01
Lard cutting oil, 25% lard, per gal.	.55	.50	.54
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	35%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.0415	.0415	.0405
Brass rods	per lb	.17373	.16873	.15373
Solder (½ and ½)	per lb.	.40	.395	.39@ 40
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.49
Cloth	3.55	2.67	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		6.50@7.00
Coke, prompt foundry, Connellsville	per net ton		7.00@7.50
White lead, dry or in oil	100 lb. kegs		New York, 15.75
Red lead, dry	100 lb. kegs		New York, 15.75
Red lead, in oil	100 lb. kegs		New York, 17.25

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in.. 1-in. diam.x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ark., Helena — Helena Wharf Improvement Dist., c/o Chamber of Commerce, will soon receive bids for loading and unloading equipment for proposed warehouse, river terminal, etc. Estimated total cost $375,000.

Calif., Los Angeles—Baash-Ross Tool Co., 5520 Boyle Ave.—machinery and equipment for proposed 1 story, 98 x 200 ft. factory. Estimated cost $100,000.

Mass., Charlestown (Boston P. O.) — Wiggin Terminals Inc., H. H. Wiggin, Pres. machinery, locomotive cranes, etc., for proposed terminal at Medford St. and Mystic River. Warren Engineering Corp., 501 Terminal St., Engrs.

Mich., Detroit—Commerce Pattern Foundry & Machine Co., 2211 Grand River Ave. sliding head drill for pattern and machine shop.

Mich., Detroit—Stewart Warner Speedometer Corp., 7321 Woodward Ave.—miscellaneous equipment for machine shop for speedometer service.

Miss., McComb—X. A. Kramer, Engr.—prices, catalogues, etc. for manufacturing equipment for creosote plant.

Mo., Springfield — C. Wilks, Marquette Hotel—5 and 10 ton traveling cranes.

N. Y., Buffalo — Donner Steel Co., 375 Abbott Road—equipment for proposed roll and finishing department shops. Estimated cost $60,000.

N. Y., Buffalo—Packard Motor Co., 300 Delaware Ave. — equipment for proposed service station on Main St. Estimated cost $175,000.

N. Y., New York—Argus Radio Corp., 25 West 18th St.—screw machine ⅝ in. capacity, lathe 12 in. swing, direct motor.

N. Y., Rochester—North East Electric Co., A. M. Anderson, Purch. Agt.—broach grinding machine (used).

O., Cleveland — The Federal Foundry Supply Co., 2639 East 79th St.—high speed riveting hammer, capacity up to ⅝ in. and heavy duty shaper.

O., Cleveland—Vitreous Enameling Co., P. O. Box 704—power brake 8 to 10 ft., press geared to 30,000 lb. with 11 to 12 in. die clearance.

O., Columbus—Atlas Fuel Co., 334 West Broad St., J. C. McIntyre, Purch. Agt.—one ton loading machine for retail coal yard.

O., Columbus — Snyder Sales Co., 676 North High St., H. B. Snyder, Genl. Mgr.—drill press medium size, air compressor and automatic machine for proposed new service station.

O., Wadsworth—Wadsworth Salt Co.—milling machine, lathe, planer, etc. for proposed new machine shop.

O., Youngstown—J. H. Fitch Co., Inc.—lathe, drill press, transmission and conveying machinery.

Pa., Latrobe—Latrobe Electric Steel Co. overhead electric crane for proposed stainless steel plant.

Pa., Pittsburgh—R. D. Nuttall Co., Harrison Ave.—horizontal boring mill, 2 drill presses, special machines.

Pa., Pittsburgh—Dept. of Supplies, City County Bldg.—motor driven Ober lathe No. 10, Crescent 24 in. planer No. 124 and 2 drum sander for proposed municipal garage and repair shop.

Pa., Scottdale—U. S. Cast Iron Pipe & Foundry Co.—15 ton overhead electric crane.

Pa., Warren—J. F. Gaughn, Poplar St. cylinder reboring machine and lathe.

Wis., Jefferson—Union Upholstering Co., B. Schweiger, Pres.— woodworking machinery for proposed 2 story upholstering plant to replace fire loss. Estimated cost $40,000.

Wis., Milwaukee — Milwaukee Service Parts Co., 1001 Cold Spring Ave.—machine tools for the manufacture of auto accessories for proposed 1 story, 60 x 100 ft. factory at Waukesha.

Wis., Milwaukee—Northwestern Malleable Co., 756 Park St.—(malleable castings, etc.) large annealing oven.

Que., Montreal—P. Demers, 2525 Clarke St. (sash and door manufacturers)—dowell machine, chain mortiser.

Que., Montreal—Frontenac Foundry Co. Reg'd., Le Pailleur St.—foundry equipment for proposed extension to plant.

Que., Montreal—N. Metsos, 135 Clarke St. (cabinetmakers, etc.) — woodworking machinery.

Que., Montreal—F. Trifilette, 300 Hurteau St.—small lathe, compressor and miscellaneous tools.

Australia, Melbourne — Victorian Government Railways will receive bids until Dec. 9 for locomotive crank, pin grading and quartering machine including all necessaray equipment; friction disk sawing machine including motor spare disk saw, tool and accessories; quantities of fibre angles, channels, tubing and washers for insulations. Address Secretary.

Opportunities for Future Business

Calif., Alameda — Boyle Mfg. Co., 1918 Park St., plans the construction of a factory for the manufacture of steel household articles at Oak and Clement Sts. Estimated cost $40,000.

Calif., Brawley — Brawley Union High School Dist. will soon award contract for the construction of addition to high school building including carpenter and machine shops. Noted April 30.

Conn., Hartford—Union Drawn Steel Co., 775 Capital Ave., awarded contract for the construction of a 1 story, 58 x 255 ft. addition to factory for the manufacture of steel products. Estimated cost $40,000.

Conn., Southington—Peck Stow & Wilcox Co., Railroad Square, manufacturers of hardware, has had plans prepared for the construction of a 2 story, 57 x 180 ft. addition to factory. Estimated cost $60,000. Private plans.

Ga., Argyle — Lou Dickey Lumber Co., Fitzgerald, plans the construction of a planing mill including dry kiln, etc. to replace fire loss here.

Ga., Columbus—Lummus Gin Co., Macon Road, awarded contract for the construction of a 1 story, 130 x 220 ft. addition to plant including machine shop. Estimated cost $50,000.

Ind., East Chicago — Edwards Valve & Mfg. Co. awarded contract for the construction of addition to plant.

Mass., Gardner—Brown Bros. Inc., Railroad St., awarded contract for the construction of a 3 story, 90 x 102 ft. factory for the manufacture of chairs. Estimated cost $40,000.

Mich., Detroit—Stewart Warner Speedometer Corp., 7321 Woodward Ave., awarded contract for the construction of a 2 story, 100 x 150 ft. service station on Cass Ave. Estimated cost $75,000.

Mich., Pontiac — Grand Trunk Railway Co., Willow Ave., subsidiary of Canadian National Railways, 230 St. Jane St., Montreal, Que., plans the construction of a 1 story, 115 x 600 ft. roundhouse and machine shop. Estimated cost $1,400,000. C. B. Brown, Ch. Engr.

Miss., Vicksburg — Lamp-Gary Mfg. Co., P. O. Box 675, will build a woodworking plant including a 50 x 200 ft. warehouse, etc. Estimated cost $125,000.

Mo., Joplin—H. N. Van Fleet, Carthage, plans the construction of a 1 story, 100 x 200 ft. sash and door factory to replace fire loss here. Private plans.

Mo., St. Louis—Southern Wheel Co., Commonwealth Bldg., Pittsburgh, Pa., is receiving bids for the construction of a group of buildings for car wheel plant at Goodfellow Ave. and Terminal R.R. here. Estimated cost $250,000. Pitzman Engineering & Surveying Co., 615 Chestnut St., is engineer. Noted Oct. 1.

Mo., Springfield — Standard Semi-Steel Foundry Co., C. Wilks, Genl. Mgr., Clinton, will build a 1 story, 64 x 200 ft. foundry at West Chase St., here. Noted Oct. 1.

Mo., Springfield — C. Wilks, Marquette Hotel, awarded contract for the construction of a 1 story, 64 x 200 ft. foundry. Estimated cost $20,000.

N. J., Bloomfield — Westinghouse Lamp Co., 120 Broadway, New York, N. Y., awarded contract for the construction of a 2 story, 93 x 113 ft. research laboratory, here. A. Y. Hodgdon, Supt. of Construction.

N. Y., North Tonawanda—W. G. Palmer, Inc., Oliver St., plans the construction of a plant for the manufacture of doors, windows and other woodwork to replace fire loss. Estimated cost to exceed $30,000.

O., Cleveland — Building Transportation Co., c/o A. Waite, of Green Cab Co., 1618 Walnut St., awarded contract for the construction of a 3 story, 110 x 120 ft. garage and storage building on Oregon Ave. Estimated cost $175,000.

O., Cleveland—Morgan Brass Co., L. Stern, Mgr., 2104 Woodland Ave., is receiving bids for the construction of a 1 story, 100 x 200 ft. foundry and machine shop. Estimated cost $60,000. Private plans.

Pa., Millvale — Bennett Lumber & Mfg. Co. awarded contract for the construction of a 1 story, 52 x 130 ft. planing mill. Estimated cost $75,000.

Pa., Philadelphia—Philadelphia Shovel Co., awarded contract for the construction of a 1 story, 55 x 130 ft. factory at Tacony and Sanger Sts. Estimated cost $45,000.

Pa., Uniontown—Richmond Radiator Co., is having plans prepared for the construction of a 1 story, 40 x 136 ft. addition to enameling plant. Private plans.

R. I., Westerly—City is receiving bids for the construction of a 2 story pumping station including machine shop. Estimated cost $25,000. W. T. Arnold, 34½ West Main St., Meriden, Conn., Engr.

Tenn., Knoxville — Oakwood Mfg. Co., Harvey St. and Marella Ave., plans the construction of a furniture factory and warehouse to replace fire loss. Estimated cost $200,000.

Wis., Kohler—Kohler Co. awarded contract for the construction of a 5 story, 82 x 200 ft. brass manufacturing plant. Estimated cost $200,000.

Wis., Milwaukee—Claus Automatic Gas Cock Co., 1614 Booth St., awarded contract for the construction of a 1 story, 100 x 125 ft. addition to factory. Estimated cost $50,000.

Wis., Milwaukee—Crucible Steel Casting Co., 612 Clinton St., awarded contract for the construction of a 1 story, 136 x 382 ft. and 40 x 60 ft. foundry and pattern storage building at 11th Ave. and R.R. tracks. Estimated cost $120,000. Noted Jan. 1.

Wis., Oshkosh — Foster-Lotham Mills, 4th and Minnesota Sts., awarded contract for the construction of a 2 story, 60 x 160 ft. addition to sash and door factory. Estimated cost $40,000.

Wis., Waukesha — Manitowoc Church Furniture Co., 1214 Lincoln Ave., awarded contract for the construction of a 1 and 2 story, 77 x 200 ft. addition to factory for the manufacture of church pews, etc. Noted June 25.

Wis., Waukesha — Waukesha Factory Building Co., G. L. Dwinnell, 448 West College Ave., plans the construction of a 1 story, 60 x 100 ft. factory. Estimated cost $40,000. Architect not selected. Milwaukee Service Parts Co., 1001 Cold Spring Ave., Milwaukee, manufacturers of auto accessories, lessee.